HDS-N Series Single Channel Handheld Digital Storage Oscilloscope & Multimeter

User Manual

- **HDS1021M-N**
- **HDS2061M-N**
- **HDS3101M-N**

www.owon.com.cn

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General Warranty

OWON warrants that the product will be free from defects in materials and workmanship for a period of 3 years from the date of purchase of the product by the original purchaser from the OWON Company. The warranty period of accessories such as probe, battery, adapter is 12 months. This warranty only applies to the original purchaser and is not transferable to the third party.

If the product proves defective during the warranty period, OWON either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by OWON for warranty work may be new or reconditioned like new performance. All replaced parts, modules and products become the property of OWON.

In order to obtain service under this warranty, Customer must notify OWON of the defect before the expiration of the warranty period. Customer shall be responsible for packaging and shipping the defective product to the service center designated by OWON, and with a copy of customer proof of purchase.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. OWON shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than OWON representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-OWON supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

Please contact the nearest OWON's Sales and Service Offices for services.

For better after-sales service, please visit www.owon.com.cn and register the purchased product online.

Excepting the after-sales services provided in this summary or the applicable warranty statements, OWON will not offer any guarantee for maintenance definitely declared or hinted, including but not limited to the implied guarantee for marketability and special-purpose acceptability. OWON should not take any responsibilities for any indirect, special or consequent damages.

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1. Declaration of Conformity

1.1 Declaration of Conformity

HDS-N Series Handheld Digital Storage Oscilloscope & Multimeter

Manufacturer: Fujian LILLIPUT Optoelectronic Technology Co., Ltd.

Statement of Conformity
Base on the result using appropriate standards, the product is in conformity with
Electromagnetic Compatibility Directive 2004/108/EC
Low Voltage Directive 2006/95/EC

Sample tests
Standards used:
EN61010-1：2001（2nd edition）
Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory use-part 1: General Requirements

EN61326-1：2006
Electrical Equipment for Measurement, Control and Laboratory use-EMC Requirements-part 1: General Requirements

EN61000-3-2：2000+A2：2005
Electromagnetic Compatibility (EMC)-part 3: Limits-Section 2: Limits for Harmonic Current Emissions (Equipment Input Current less than/equal to 16A per phase)

EN61000-3-3：1995+A1：2001
Electromagnetic Compatibility (EMC)-part 3: Limits-Section 3 Limitation of Voltage Fluctuations and Flicker in Low-Voltage Supply systems for Equipment with Rated Current less than or equal to 16A

The tests have been performed in typical configuration.
This conformity is indicated by the symbol CE, i.e. "Conformite Europeenne".

1.2 Package Contents

See the picture below. This picture is only for your reference. If any discrepancy found between certain picture and product, please look the actual product.

#	Description	Standard	Optional
1	Oscilloscope and Battery	●	
2	AC-DC adapter	●	
3	Oscilloscope Probe × 1 (grey)	●	
4	Multimeter test lead × 2 (black and red)	●	
5	USB Mass Storage connect cable	●	
6	Extension module for capacitance measurement	●	
7	Probe adjustment tools	●	
8	USB communication cable or RS-232C communication cable	●	
9	User Manual	●	
10	CD-ROM (software)	●	
11	Metal carrying case		●
12	Soft carrying case		●
13	The output terminal of 1 kHz 5 V square-wave test signal	●	



Figure 1: Digital Oscilloscope Parts

2. Safety Information

In order to ensure the correct using and the best efficient service, please carefully read this user's manual.

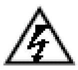
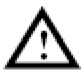
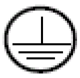
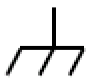
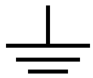
2.1 Safety Symbols and Terms

2.1.1 Safety Symbols

These symbols may appear in this manual or on the instrument.

 **Warning**: "Warning" identifies conditions and actions that pose hazards to the users.

 **Caution:** "Caution" identifies conditions and actions that may damage the product or other properties.

DANGER: High Voltage	Refer to the Manual	Protective Conductor Terminal	Chassis Ground	Earth (ground) Terminal
				

2.1.2 Safety Terms

The following terms may appear on the instrument:

Danger: The term "Danger" is used in this manual to indicate that when you read this mark, personal injury may be caused to you immediately.

Warning: The term "Warning" is used in this manual to indicate that when you read this mark, personal injury may not be caused to you immediately, but you need to be cautionary.

Notice: The term "Notice" is used in this manual to indicate that damages may be caused on this product or other properties.

2.2 General Safety Information

Carefully read the following safety information in order to avoid any personal injury and damage on this product or any products connected with it. This product can only be used in the specified

applications to prevent any possible dangers.

⚠ **Warning:**

To avoid fire or electrical shock, please use proper power adapter. Use only the power adapter appointed by the manufacturer and subject to approval of being used in the user's country.

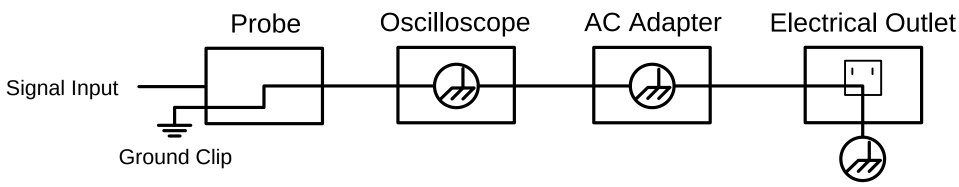
⚠ **Warning:**

The two channels of the oscilloscope are non-isolated electrically. The channels should adopt common basis during measuring. To prevent short circuits, the 2 probe ground must not be connected to 2 different non-isolated DC level.

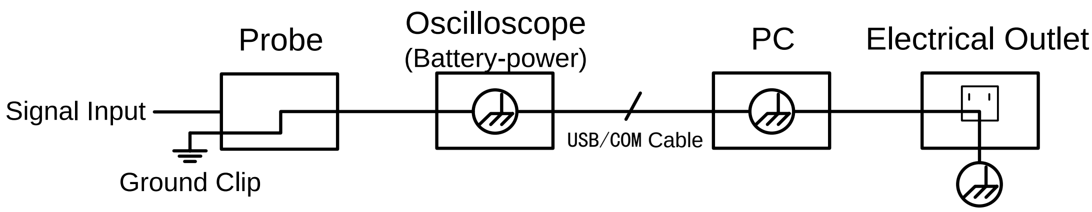
⚠ **Warning:**

The channels should adopt common basis during measuring. To prevent short circuits, the 2 probe ground must not be connected to 2 different non-isolated DC level.

The diagram of the oscilloscope ground wire connection:



The diagram of the ground wire connection when the battery-powered oscilloscope is connected to the AC-powered PC through the ports:



It is not allowed to measure AC power when the oscilloscope is AC powered through the adapter, or when the battery-powered oscilloscope is connected to the AC-powered PC through the ports.

⚠ **Warning:**

To avoid fire or electrical shock if a test tool input is connected to more 42V peak (30Vrms) or on circuits of more than 4800VA:

- **Use only insulated voltage probes, test leads and adapter supplied with the test tool, or indicated by OWON as suitable for the Oscilloscope & Multimeter.**
- **Before use, inspect voltage probes, test leads and accessories for mechanical damage and replace when damaged.**
- **Remove all probes, test leads and accessories that are not in use.**

- **Always connect the power adapter first to the AC outlet before connecting it to the Oscilloscope & Multimeter.**
- **Do not apply voltages that differ more than 400 V from earth ground to any input when measuring in a CAT Ⅱ environment.**
- **Do not apply voltages that differ more than 400 V from each other to the isolated inputs when measuring in a CAT Ⅱ environment.**
- **Do not apply input voltages above the rating of the instrument Use caution when using 1:1 test leads because the probe tip voltage will be directly transmitted to the Oscilloscope & Multimeter.**
- **Do not use exposed metal BNC or banana plug connectors.**
- **Do not insert metal objects into connectors.**
- **Always use the Oscilloscope & Multimeter only in the manner specified.**
- **Voltage ratings that are mentioned in the warning are giver as limits for "working voltage". The represent V ac rms (50-60Hz) for AC sine wave applications and as V dc for DC applications. Overvoltage Category Ⅱ refers to local level , which is applicable for appliances and portable equipment .**

Only qualified technical personnel are permitted to perform maintenance.

Pay attention to the nominal values of all terminals: To avoid fire or electric shock, please keep a watchful eye on all nominal values and marks specified for this product. Before any connection performed on this product, carefully read the user's manual of the product for further information of nominal values.

No operation is allowed without the instrument cover plate: If the cover plate or panel has been removed, do not perform any operation on this product.

No touch is allowed on bare conductors: When the product is powered on, do not touch any bare joints or parts of the scope meter.

Operation is prohibited in case of any undetermined failure: When in doubt any damage on this product, consult the qualified personnel for checking on it.

Keep ventilation in good condition: Refer to the user manual for detail installation instructions in order to fix this product correctly and provide it with good ventilation conditions.

No operation is allowed under a humid environment.

No operation is allowed under an explosive environment.

Keep clean and dry on the product surface.

Using the Oscilloscope & Multimeter in a manner not specified may impair the protection provided by the equipment.

3. General Characteristics

Oscilloscope

- 2 in 1 (Multimeter function support);
- Record length of 6,000 points for each channel;
- Reading-out with the cursor;
- Eighteen automatic measurement functions;
- Autoscale function;
- Color liquid crystal display of high resolution and high contrast with adjustable back light;
- Storage and call-out of waveforms;
- Automatic setting function provided capable of fast setting;
- FFT function
- Implementation of detecting the average and peak values of the waveform;
- Edge and video triggering function;
- RS232 or USB communication ports;
- Multiple Language User Interface.

Multimeter

- 3 and 3/4 digits;
- Volts, Amps, Ohms, Diode, Capacitance, Continuity measurement;
- 10A maximum amplitude;
- Isolated inputs between oscilloscope and multimeter.

4. Performing the General Inspection

4.1 Performing the General Inspection

When you have got a new HDS-N series oscilloscope, it is suggested that you should perform a general inspection on the instrument according to the following steps.

4.1.1 Check whether there is any Damage on it Due to Transportation

If the packing boxes or foam cushions are found in serous damage, keep them in a proper place until the complete instrument and accessories have passed the electrical and mechanical tests.

4.1.2 Make a Check on Accessories

The accessory list has been described in the picture of Digital Oscilloscope Parts of this manual. You can make a check and find whether there is any accessory loss with reference to the Appendix. In case of any accessory loss or damage, consult the OWON dealer responsible for such a business or the local office of OWON.

4.1.3 Make a Check on the Complete Instrument

If the instrument is damaged in its appearance or it fails in normal operation or performance test, consult the OWON dealer responsible for such a business or the local office of OWON. If the instrument is damaged due to transportation, keep the packing in a proper place and consult the transportation department and the OWON dealer responsible for such business, who will provide an instrument replacement or maintenance.

5. Input Connections

5.1 Input Connections

5.1.1 Input connections

See the following Figure 2:



Figure 2：Input connections

Description:

1. The power adapter is supplied for AC power supply and battery recharging.
2. Multimeter test lead.
3. Multimeter input jacks, including four circular banana jacks. The first jack measuring the current 2 A-10A, the second jack on the current Measurement, the third COM ground input, and the fourth measuring voltage, resistance, Capacitance input.
4. Oscilloscope probe.
5. Oscilloscope channel input.
6. The output terminal of 1 kHz/5 V square-wave test signal.

5.1.2 The connection of 1 kHz/5 V Square-wave test signal

At the left side of the oscilloscope, it is a port for testing 1 kHz/5 V square-wave signal which is used to adjust the probe, shown as Fig.3



Fig.3. The connection of Square-wave test signal

5.2 Front Panel and Keys Overview

See the following Figure 4:



Figure 4： Front Panel

Description:

1. AC adapter Port
2. RS-232C Port.
3. USB Port.
4. USB Mass Storage Port.
5. Power switch.
6. F1 - F5: Switch or Adjust options for each menu.

7. AUTO SET: Under DSO mode, automatically selects the horizontal scales, vertical scale, and trigger level according to the input signal.
8. COPY: Press to save the waveform data into the USB Mass Storage Device.
9. ▲ (red): Adjust vertical position in Channel.
10. VERTICAL ZERO (red): Adjust vertical position to zero.
11. ▼ (red): Adjust vertical position.
12. + (red): Adjust voltage scale.
13. CHANNEL SETTING (red): Enter Channel settings directly.
14. - (red): Adjust voltage scale.
15. RUN/STOP: key for running or stopping the operation
16. LIGHT: backlight control.
17. DMM/OSC: Operation mode switching key between oscilloscope and multimeter.
18. MENU ▲: Choose the upper item on the menu list.
19. MENU: Show / Hide the menu
20. MENU ▼: Choose the lower item on the menu list.
21. OPTION: the key for DSO setting and combines with four arrow keys. Then to set main time base, trigger horizontal position and trigger vertical position. Furthermore adjust cursor 1 (V1 or T1) and cursor 2 (V2 or T2) position during cursor measurement.
22. ▲ (OPTION): Oscilloscope display upward adjustment key.
23. ▼ (OPTION): Oscilloscope display downward adjustment key.
24. ► (OPTION): Oscilloscope right-direction adjustment key.
25. ◄ (OPTION): Oscilloscope left-direction adjustment key.
26. **A**: Selects DMM current measurement
27. **V**: Selects DMM voltage measurement
28. **R**: Selects DMM impedance, diode, continuity and capacitance measurement
29. **SET**: convert AC and DC during measure current or voltage in Multi-meter; convert resistance, diode, on-off and capacitance measure during resistance measuring.

6. Using the Oscilloscope

6.1 About this Chapter

This chapter provides a step-by-step introduction to the scope functions. The introduction does not cover all of the capabilities of the scope functions but gives basic examples to show how to use the menus and perform basic operations.

6.2 Powering Up the Oscilloscope

Connect oscilloscope to AC power via AC-DC adapter as shown in Figure 1. (The oscilloscope may still work with built-in Li-ion battery even without AC power supply).

Turn the oscilloscope on by pressing down the power on/off key ⏻.

The instrument then performs self checking after power on. A greeting window and a sentence "Press any key to continue." will display on the screen when the system finishes self checking.
The users can press any key to enter the measuring function.
The oscilloscope is powered up in its last setup configuration.

6.3 Oscilloscope Operation Window

See the following figure 5:

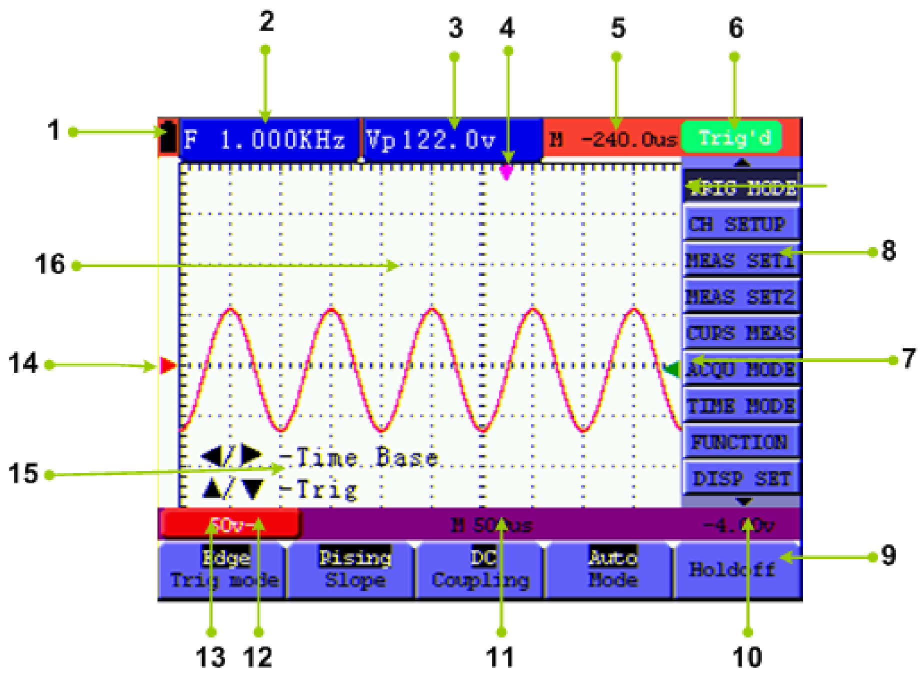


Figure 5: Oscilloscope Operation Window

Description:

1. Battery electric quantity indicating symbols.
2. Auto measurement window 1, in which "F "means frequency, "T" means cycle, "V" means the average value, "Vp" the peak-peak value ,"Vr" the root-mean-square value,. "Ma" the maximum amplitude value, "Mi" the minimum amplitude value, "Vt" the Voltage value of the waveform's flat top value, "Vb" the Voltage value of the waveform's flat base, "Va" the amplitude value, "Os" the overshoot value, "Ps" the Preshoot value, "RT" the rise time value, "FT" the fall time value, "PW" the +width value, "NW" the -Width value, "+D" the +Duty value, "-D" the -Duty value.
3. Auto measurement window 2.
4. The pointer indicates the horizontal triggering position.
5. This reading gives the Time Difference between the horizontal triggering position and the screen centerline. It reads zero when the pointer is in the center of the screen.
6. The trigger state indicates the following information.

   Auto: The oscilloscope is working in the automatic mode and displaying the waveform under the non-trigger state.

   Trig'd: The oscilloscope has detected a trigger and collecting the information generated after the trigger.

   Ready: All pre-triggered data have been captured and the oscilloscope has been ready to receive trigger signals.

   Scan: The oscilloscope can gather and display the waveform data continuously in scanning mode.

   Stop: The oscilloscope has stopped collecting the waveform data.
7. Green pointer indicates vertical trigger position when edge trigger, and no green pointer when video trigger.
8. A hidden-style menu: With the **MENU** key pressed, you can view or hide the menu.
9. Menu setting options: There are different setting options for different menus.
10. It reads the value of trigger voltage level.
11. The reading gives the value of primary time base.
12. These graphics present the coupling modes of channel . The graphic "～" indicates AC, the graphic "－" indicates DC, the graphic " ⏚ " indicates GND.
13. This reading shows the vertical Voltage Unit Scale of channel.
14. The red pointer gives the grounding datum point of the waveform on channel, which is the zero position of channel. No display of this pointer indicates that the channel has not been

opened.

15. OPTION operation prompt: There are different prompts for different OPTION operations.

16. Waveform display area, and the wave shows red.

6.4 Menu Description

The following example shows how to use the tool's menus to select a function, as shown in the following figure.

1. Press the **MENU** key to display the Function Menu on the right of the screen and the corresponding optional settings on the bottom. Press **MENU** again will hide the Function Menu.
2. Press the **MENU** ▲ or **MENU** ▼ key to select different function menus.
3. Choose one key from **F1** to **F5** and press it to change function setting.

See the following figure 6:

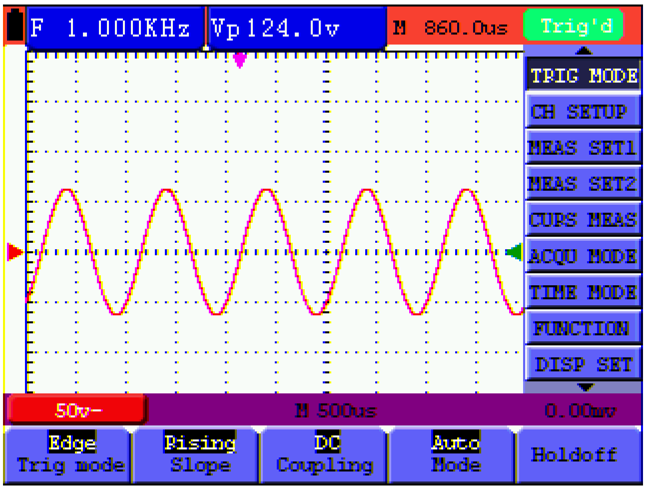


Figure 6: the Tool's Menus

6.5 Manually Setting the Vertical System, Horizontal System and Trigger Position

6.5.1 Setting the Vertical System

To set the vertical position of channel:

(1) The key ▲ **(red)** and ▼ **(red)** can be used to adjust the vertical position of channel; the relevant information will be displayed at the left bottom of the screen.

(2) The key + **(red)** and - **(red)** can be used to adjust the voltage scale of channel; the relevant information will be displayed at the left bottom of the screen.

Note: Press **VERTICAL ZERO (red)** key to set the vertical position of channel to zero.

6.5.2 Setting the Horizontal System and Trigger Position

OPTION key is a multiple setting key to set trigger vertical position, main time base and horizontal position (trigger horizontal position) during edge trigger and video trigger.

The following example shows how to use **OPTION** key to make a setting.

The following guidance is for the operation on the mode of edge triggering and video triggering.

1. Press once the **OPTION** key; the following is displayed at the bottom left side of the screen, as shown in the figure below.

   ◄/► – Time Base

   ▲/▼ – Trig

See the following figure 7:

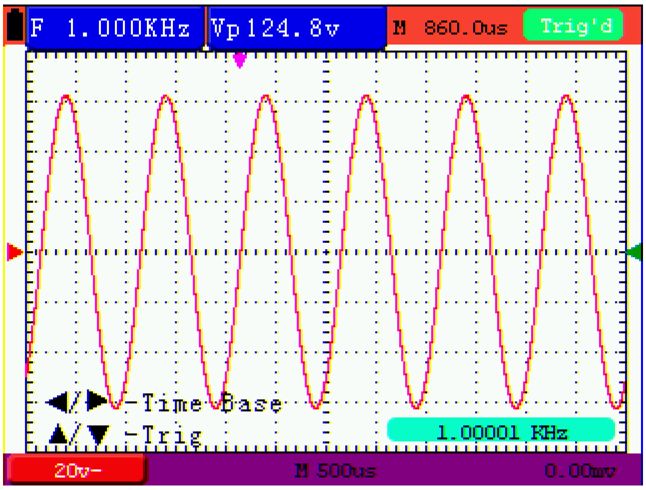


Figure 7

2. Press ◄ (OPTION) or ► (OPTION) to adjust the main time base; press ▲ (OPTION) or▼ (OPTION) to adjust trigger level position, press **R** key to "zero" the trigger level position.

3. Press **OPTION** again and left bottom side display as

   ◄/► – Time

   ▲/▼ – Trig

See the following figure 8:

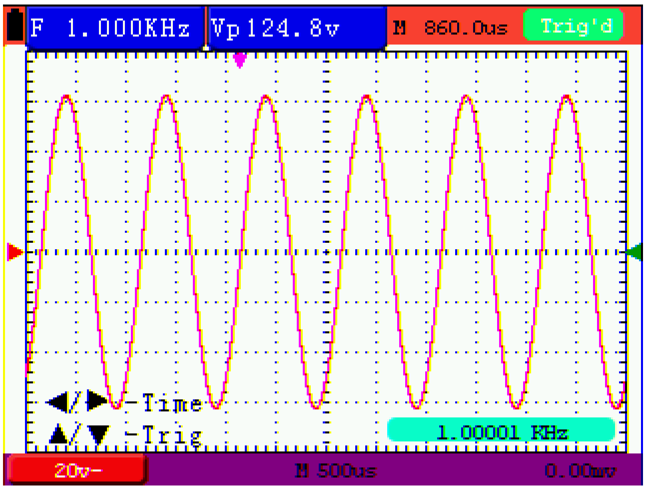


Figure 8

4. Press **◄(** OPTION**)** or **►(** OPTION**)** to adjust time base horizontal position, press **V** key to "zero" the horizontal position; press **▲(**OPTION**)** or **▼(**OPTION**)** to adjust trigger level position, press **R** key to "zero" the trigger level position.
5. Press **OPTION** again to back up operation 1.

Term interpretation

- **Vertical scale factor:** It stands for the voltage amplitude represented by a division in the vertical direction of the display area, through the adjustment of which you can amplify or attenuate the signal and thus regulate the signal amplitude into the expected measurement range.
- **Vertical zero position:** It is referred to as the grounding datum point, through the adjustment of which you can regulate the display position of the waveform on the screen.
- **Main time base:** It means the time values represented by a division in the horizontal direction of the display area.
- **Trigger horizontal position:** It means the time deviation between the actual trigger point and the screen central line, which will be displayed as 0 at the center point of the screen.
- **Trigger level position:** It represents the voltage deviation between the actual trigger level and the zero position of the triggering signal source channel.

6.6 Recall factory settings

If you want to reset the Oscilloscope to the factory settings, do the following:

1. Press **MENU** key and the function menu appears on the right side of the screen
2. Press the **MENU ▲** or **MENU ▼** key to select **FUNCTION** setting and three options are visible at the bottom of the screen.

3. Press **F1** key to select "**Recall Factor**y" to recall the factory settings.

4. Press **F2** key to select "**Auto calibration**". If the ambient temperature variation is up to or larger than 5 Celsius degree, the Auto calibration function should be performed. But this will not affect the using and capability by the heat from LCD and electronic component

See the following Figure 9:

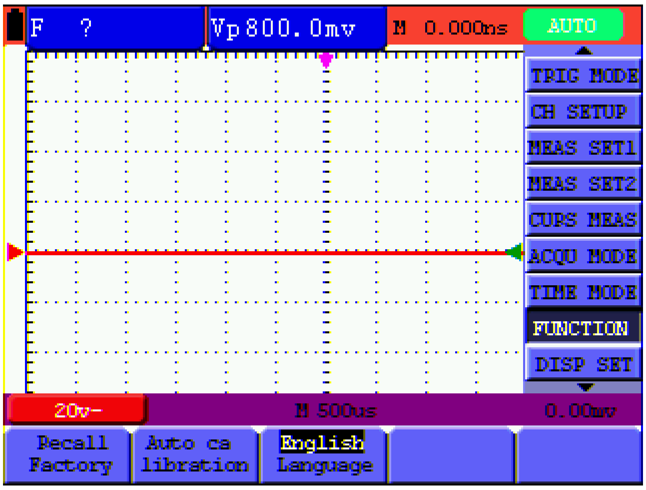


Figure 9: Reset the Oscilloscope

6.7 Input Connections

See Figure 2 on P8.

Look at the bottom and the right of the Oscilloscope. The Oscilloscope has six signal inputs: one safety BNC jack inputs (CH) for scope measurements, four safety 4-mm banana jack inputs for Multimeter R, V and A measurements.

Isolated input allows independent floating measurements between Multimeters and Scopes.

6.8 Displaying an Unknown Signal with Auto Set

The Auto-Set feature lets the Oscilloscope display and measure unknown signals automatically. This function optimizes the position, range, time base and triggering, assures a stable display of virtually any waveform. This feature is especially useful for quickly checking several signals.

To enable the Auto-Set feature, do the following:

1. Connect the test probe to the tested signals.

2. Press the **AUTO SET** key and the Oscilloscope is under the automatic measurement condition. The tested signals appear on the screen.

6.9 Automatic Zero-returning of Trigger Horizontal Position and Trigger Level Position

When we adjust the trigger horizontal position and trigger level position to be maximal to make it off the screen center remotely, then we perform the following steps to make trigger horizontal position and trigger level position return to zero automatically.

1. Press **V** key, the trigger horizontal position automatically returns to zero.
2. Press **R** key, the trigger level position automatically returns to zero.

6.10 Automatic Measurements

The Oscilloscope offers 18 ranges of automatic scope measurements. Your can display two numeric readings: **measurement 1** and **measurement 2**. These readings are selectable independently, and the measurements can be done on the input waveform.

To choose a frequency measurement, do the following:

1. Press **MENU** key and the function menu appears on the right side of the screen.
2. Press **MENU ▲** or **MENU ▼** key to select **MEAS SET1**. Four items selectable are visible at the bottom of the screen.
3. Press **F1** key to select **Freq** measurement. The **measurement 1** window shows the frequency for input waveform.

To choose a Peak-Peak measurement, do the following:

1. Press **MENU** key and the function menu are displayed on the right side of the screen.
2. Press **MENU ▲** or **MENU ▼** key and select **MEAS SET2**, with 4 items selectable displayed at the bottom of the screen.
3. Press **F4** key to select **PK-PK** measurement. The **measurement 2** window shows the peak-peak value for input waveform.

See the following figure 10:

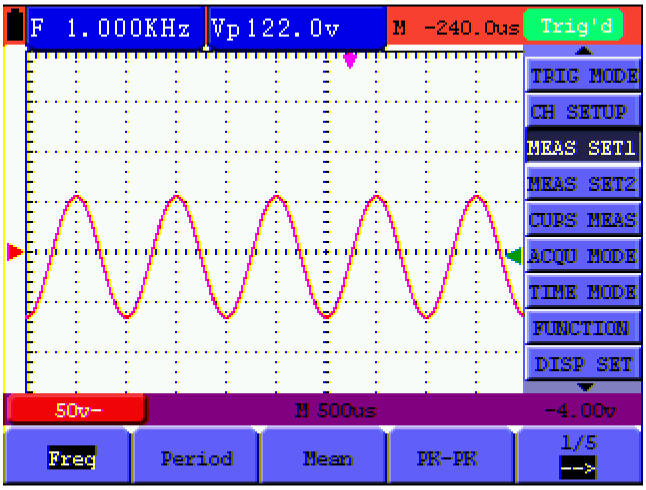


Figure 10: Automatic Scope Measurements

6.11 Freezing the Screen

You can freeze the screen (all readings and waveforms)

1. Press the **RUN/STOP** key to freeze the screen and **STOP** appears at top right side of the screen.
2. Press the **RUN/STOP** key once more to resume your measurement.

See the following figure 11:

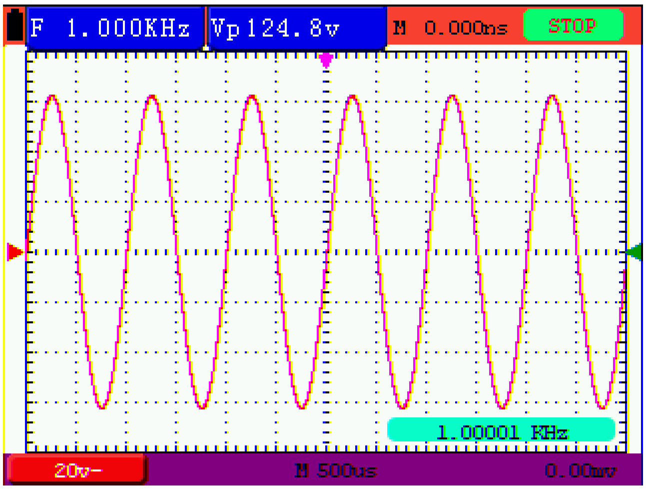


Figure 11: Freezing the Screen

6.12 Using Average for Smoothing Waveforms

Using the Average acquisition mode, you can smooth out the displayed waveform by averaging multiple data samples. The number of averaging is selectable from 4, 16, 64, and 128.

Note: In order for average mode to work in the best way, the waveform must be repetitive; As the

number of averaging increases, the slower the waveform update becomes.

1. Press the **MENU** key and the function menu appears on the right side of the screen.
2. Press **MENU ▲** or **MENU ▼** key to select **ACQU MODE**, with four items selectable displayed at the bottom of the screen.
3. Press the **F3** key to select **Average**, then, press **F4** key to jump to **Averages 64** item. This averages the outcomes of 64 acquisitions and shows the final averaging result on the screen, shown as the following figures.

See the following figure 12:

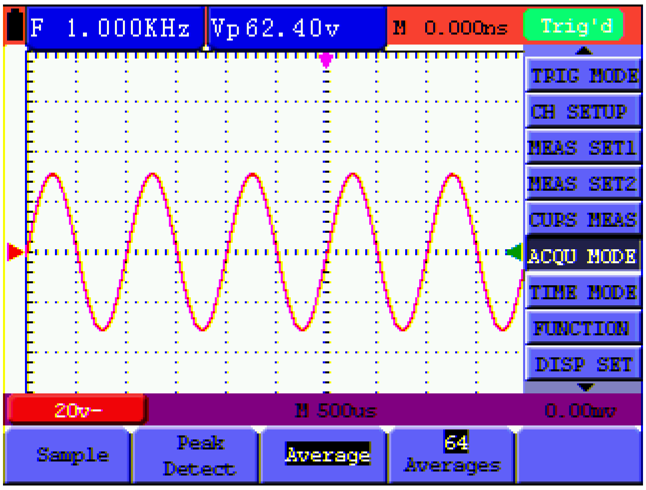


Figure 12: Average Factor Sampling Mode

6.13 Using Persistence to Display Waveforms

You can use Persistence to observe dynamic signals.

1. Press **MENU** key and the function menu appears on the right side of the screen.
2. Press **MENU ▲** or **MENU ▼** key to select **DISP SET.**
3. Press **F2** key to select **Persist 1 sec, 2 sec, 5 sec, Infinite** or **OFF**. In this case, jump to **Infinite** and the observed dynamic is kept on the screen continuously. When the item **OFF** is selected, the Persistence function is closed.

Look at the display, a screen like the following figure 13 can be shown.

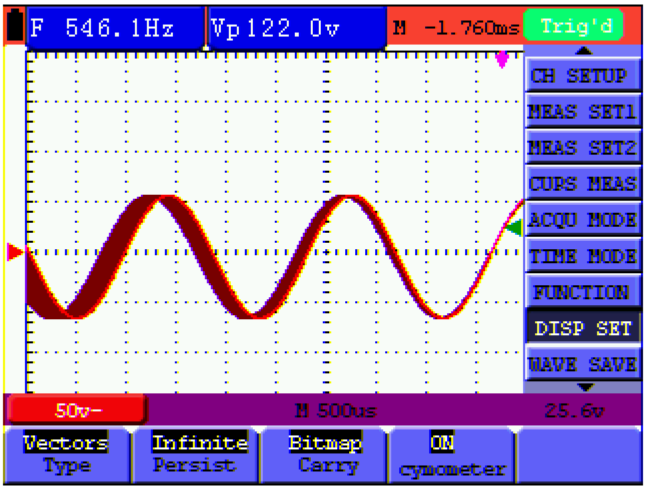


Figure 13: Persistence to Observe Dynamic Signals

6.14 Using Peak Detection to Display Glitches

You can use this function to display events (glitches or other asynchronous waveforms) of 50 ns or wider.

1. Press **MENU** key and the function menu appear at the right side of the screen.
2. Press **MENU ▲** or **MENU ▼** key to select the **ACQU MODE**. Four items selectable are displayed at the bottom of the screen.
3. Press **F2** key and jump to **Peak Detect**. In this case, you can test the glitch.

Now, you can see a screen that looks like the following figure 14.

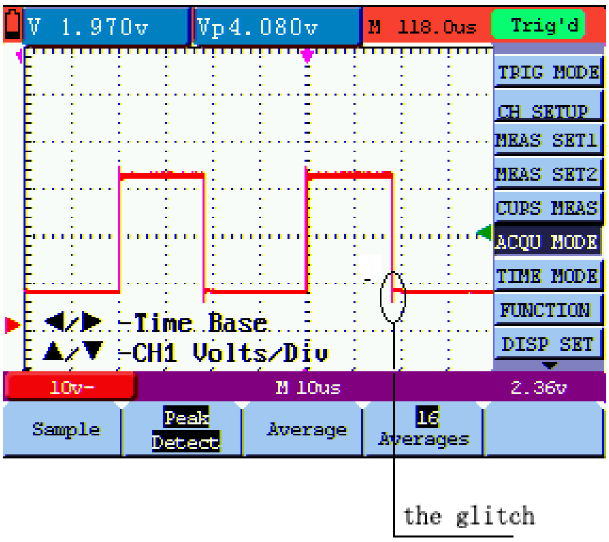


Figure 14: Peak Detection

Term interpretation

Collecting mode: The oscilloscope transforms the collected analog data into a digital form after they are gathered in the following three different modes, that is, sampling, peak value detection and averaging values.

Sampling: The oscilloscope takes samples from the signal at a equal time interval to reconstruct the waveform in this mode, by which the analog signal can be expressed correctly in most cases, yet, the rapid changes can not be collected between two sampling time intervals, causing the confusion and loss the narrow pulse in the signal probably.

Peak value detection: The oscilloscope takes samples from the maximum and minimum of signals in each sampling interval and shows the waveform with the sampled data in this mode, thus, by which the oscilloscope may collect the possibly lost narrow pulse in the sampling mode but the noise is obvious.

Averaging values: the oscilloscope collects several waveforms and average over them, and displays the averaged waveform in this mode, by which the random noise can be reduced.

Duration time: When a new waveform is displayed, the previous waveform shown on the screen does not disappear immediately only to be displayed for a period of time, that is, the duration time, by setting which, the waveform can be displayed more continuously and thus a display similar to that shown by the analog oscilloscope can be achieved.

Roll scan mode: The oscilloscope updates the waveform sampling points by scrolling display through a screen from left to right in this mode, which is only applicable to the primary time base setting of above 50ms.

6.15 Selecting AC-coupling

After a reset, the Oscilloscope is dc-coupled so that ac and dc voltages appear on the screen, Use ac-coupling when you wish to observe a small ac signal that rides on a dc signal. To select ac-coupling, do the following:

1. Press **MENU** key and the function menu appear at the right side of the screen.
2. Press **MENU ▲** or **MENU ▼** key to select **CH SETUP.** Four items selectable are visible at the bottom of the screen.
3. Press the **F1** key and jump to **AC**. The bottom left side of the screen displays the ac-coupling icon.

Now, you can see a screen that looks like the following figure 15.

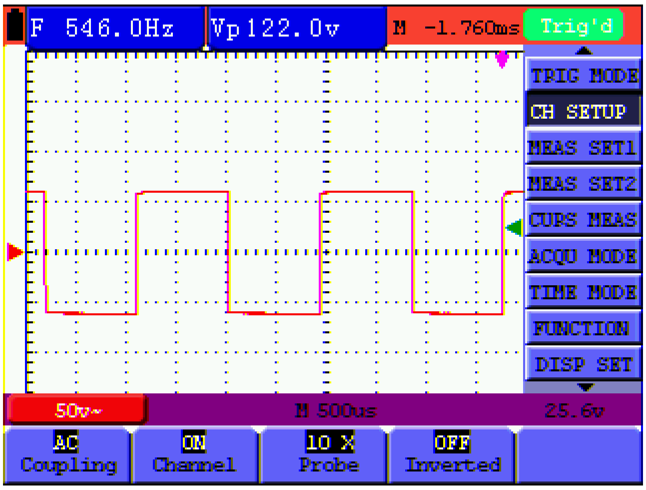


Figure 15: AC-Coupling

6.16 Reversing the Polarity of the Displayed Waveform

To invert the input waveform, do the following:

1. Press the **MENU** key and the function menu appears at the right side of the screen.
2. Press the **MENU ▲** or **MENU ▼** key to select **CH SETUP**. Four items selectable are displayed at the bottom of the screen.
3. Press **F4** key to jump to **Inverted,** set it as **ON**. The inverted waveform is displayed on the screen.

Now, you can see a screen that looks like the following figure 16.

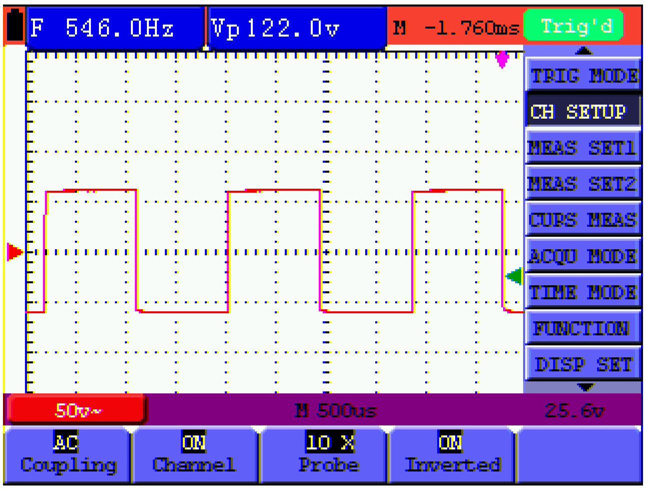


Figure 16: Inverted On

6.17 Use USB mass storage device to save waveform data

Insert the USB mass storage device into the USB port and press copy key, then the current

waveform data will be saved into the USB mass. The save waveform has two format, one is vector format and the other is bitmap format, according to the display settings from the choice of the communication settings. Name the file with current date and suffix by .bin or .bmp. Then connect the USB mass storage device with the computer after data is saved, and open the data of vector format with OWON analysis software, or direct open the bitmap.

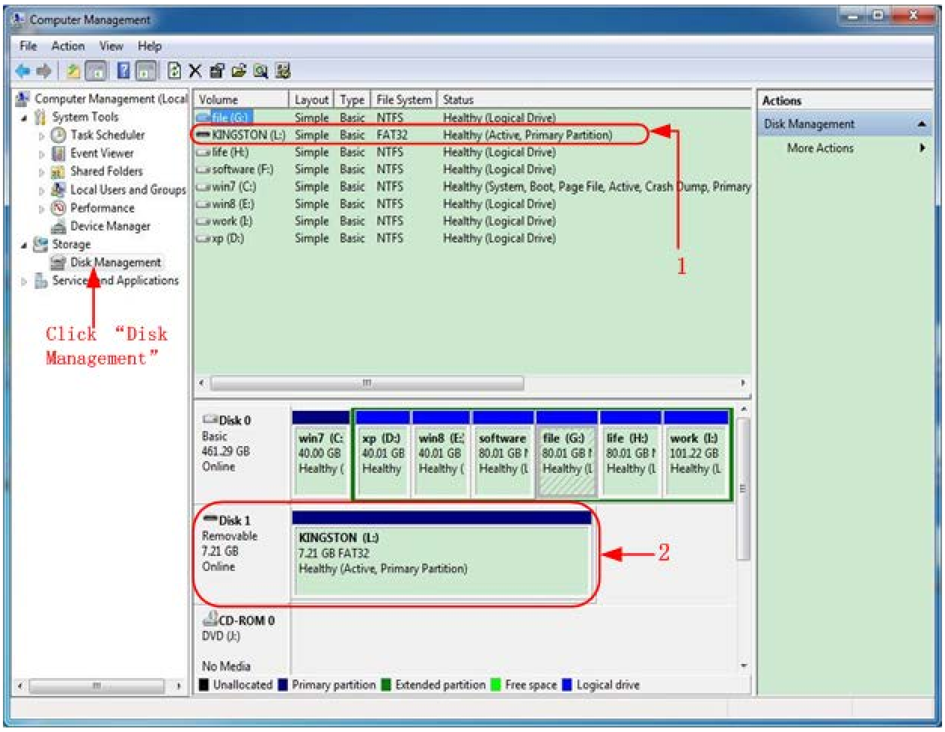
Note: It has clew in a series of process USB operation storage, such as "USB save successfully".

USB disk Requirements

The supported format of the USB disk: FAT32 file system, the allocation unit size cannot exceed 4K, mass storage USB disk is also supported. If the USB disk doesn't work properly, format it into the supported format and try again. Follow any of the following two methods to format the USB disk: using system-provided function and using the formatting tools. (The USB disk of 8 G or 8 G above can only be formatted using the second method – using the formatting tools.)

Use system-provided function to format the USB disk

1. Connect the USB disk to the computer.
2. Right click **Computer**-→ **Manage** to enter Computer Management interface.
3. Click Disk Management menu, and information about the USB disk will display on the right side with red mark 1 and 2.



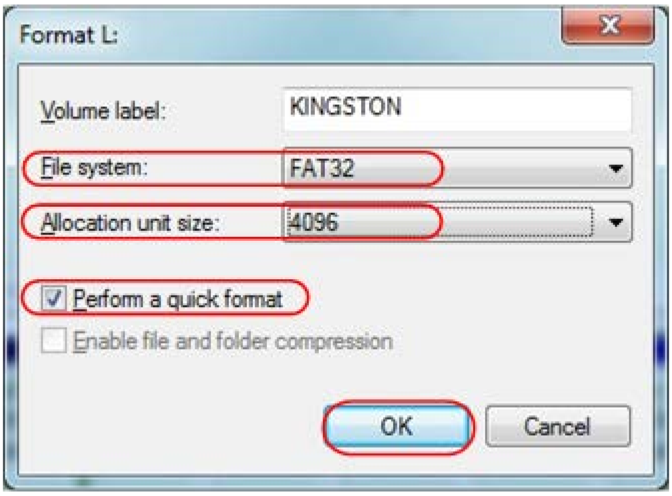
Disk Management of computer

4. Right click 1 or 2 red mark area, choose **Format**. And system will pop up a warning message, click **Yes**.



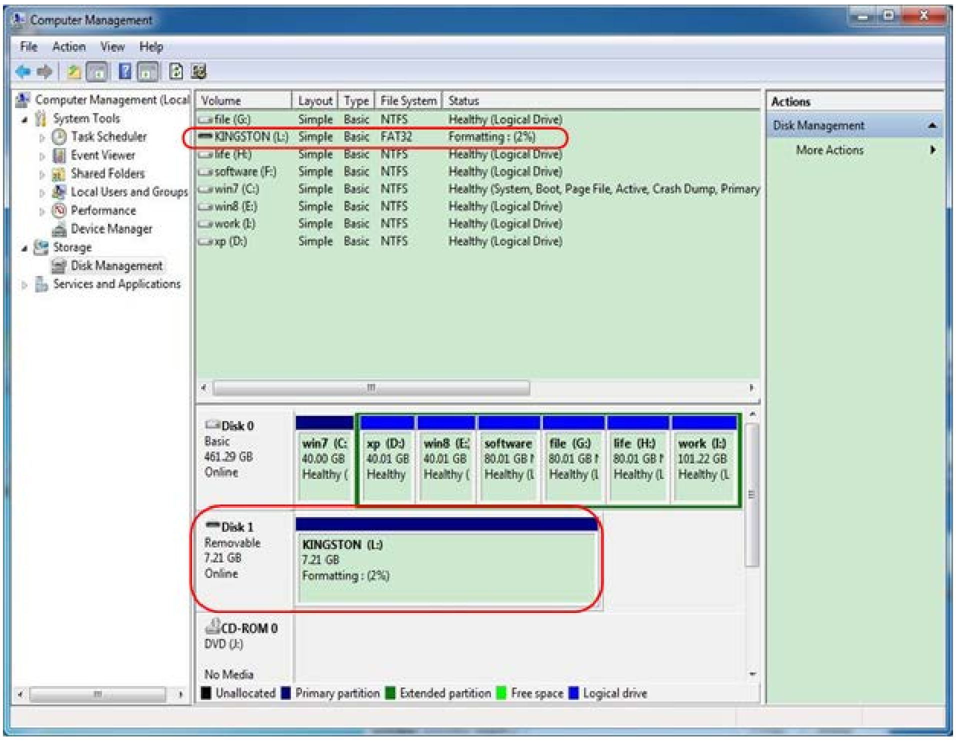
Format the USB disk warning

5. Set File System as FAT32, Allocation unit size 4096. Check "**Perform a quick format**" to execute a quick format. Click **OK**, and then click **Yes** on the warning message.



Formatting the USB disk setting

6. Formatting process.



Formatting the USB disk

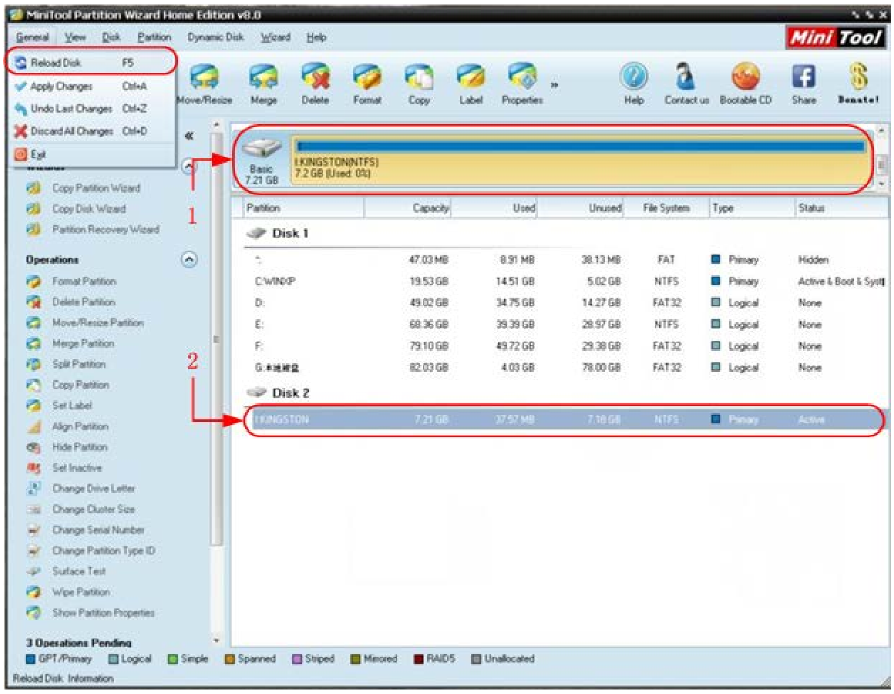
7. Check whether the USB disk is FAT32 with allocation unit size 4096 after formatting.

Use Minitool Partition Wizard to format

Download URL: **http://www.partitionwizard.com/free-partition-manager.html**

Tip: There are many tools for the USB disk formatting on the market, just take Minitool Partition Wizard for example here.

1. Connect the USB disk to the computer.
2. Open the software **Minitool Partition Wizard.**
3. Click **Reload Disk** on the pull-down menu at the top left or press keyboard F5, and information about the USB disk will display on the right side with red mark 1 and 2.



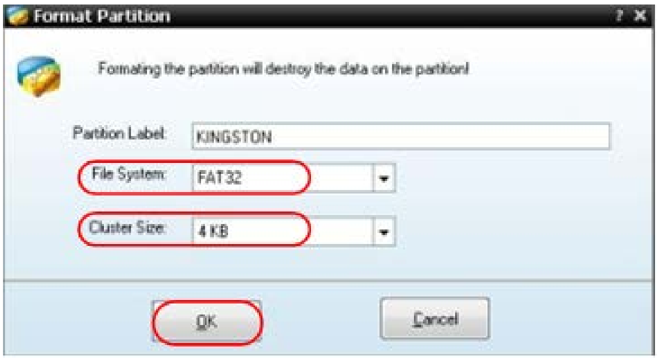
Reload Disk

4. Right click 1 or 2 red mark area, choose **Format**.



Choose format

5. Set File System FAT32, Cluster size 4096. Click **OK**.



Format setting

6. Click **Apply** at the top left of the menu. Then click **Yes** on the pop-up warning to begin formatting.



Apply setting

7. Formatting process



Format process

8. Format the USB disk successfully



Format successfully

7. Using the Multimeter

7.1 About this Chapter

This chapter provides a step-by-step introduction to the multi-meter functions of the test tool hereafter. The introduction gives basic examples to show how to use the menus and perform basic operations.

7.2 Making Meter Connections

Use the four 4-mm safety banana jack inputs for the Meter functions: **10A, mA, COM, V/Ω/C.**

See figure 2 on P8 for the connections.

7.3 Multimeter Operation Window

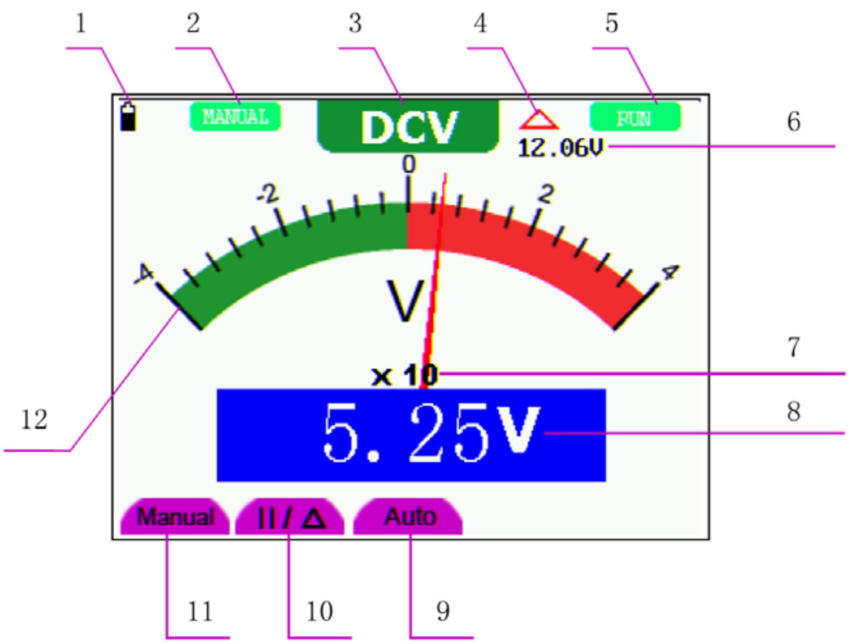


Figure 17: Multimeter Operation Window

Description

1. Battery electric quantity indicator.
2. Manual/Auto range indicators, among which the **MANUAL** means measuring range in manual operation mode and **AUTO** refers to the measuring range in automatic operation mode.

3. Measurement mode indicators:

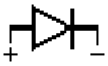
   DCV: Direct voltage measurement

   ACV: Alternating voltage measurement

   DCA: Direct current measurement

   ACA: Alternating current measurement

   R: Resistance measurement

    : Diode measurement

    : On/Off measurement

   C: Capacitance measurement

4. The relative magnitude measurement indicator.
5. Running state indicators, among which **RUN** expresses continuous update and **STOP** represents the screen locking.
6. The reference value of the relative magnitude measurement.
7. The multiplying power of the dial indication. To multiply the reading of dial pointer by multiplying power will get the measurement result.
8. The main reading of measurement
9. Automatic control measuring range.
10. Absolute/ relative magnitude measuring control: The sign "||" expresses the absolute magnitude measuring control and "△" represents the relative magnitude measuring control.

    Manually measuring range control.
11. Manual measurement control.
12. Test lead indicated the scale of test reading; different test modes display different colors.

7.4 Making Multimeter Measurements

Press **DMM/OSC** key, the oscilloscope will switch to the multimeter measure; the screen will display the multimeter windows.

7.4.1 Measuring Resistance Values

To measure a resistance, do the following:

1. Press the **R** key and **R** appears at the top of the screen.

2. Insert the black lead into the **COM** banana jack input and the red lead into the **V/Ω/C** banana jack input.

3. Connect the red and black test leads to the resistor. The resistor value readings are shown on the screen in Ohm.

Now, you can see a screen that looks like the following figure 18.

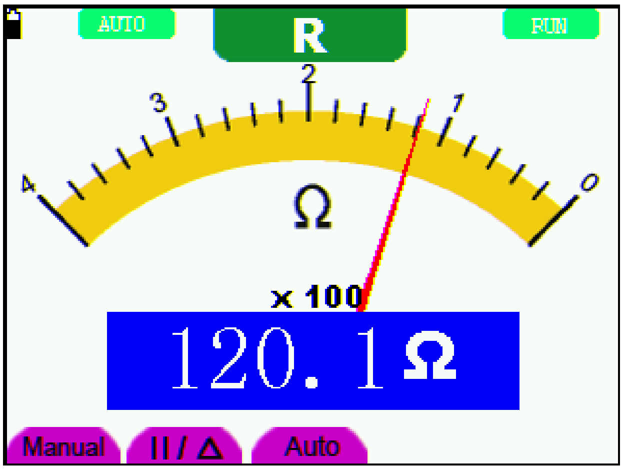
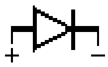


Figure 18: Resistance Measurement

7.4.2 Measuring Diode

To make a measurement on the diode, do the following:

1. Press the **R** key and **R** appears at the top of the screen.

2. Press **SET** key until the following is displayed on the screen  .

3. Insert the black lead into the **COM** banana jack input and the red lead into the **V/Ω/C** banana jack input.

4. Connect the red and black leads to the resistor and the diode resistor readings are displayed on the screen in **V**.

Now, you can see a screen that looks like the following figure 19.

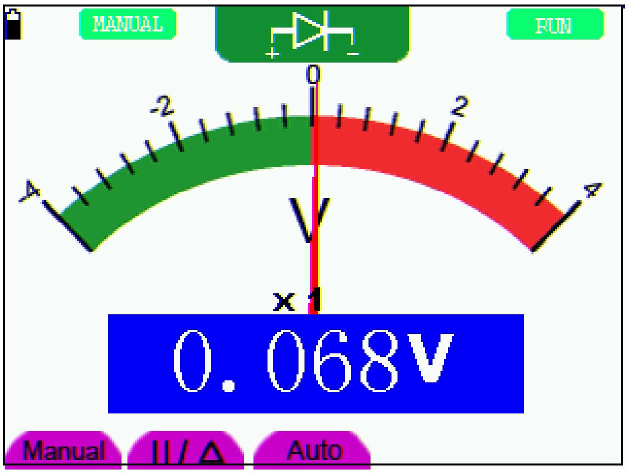


Figure 19: Diode Measurement

7.4.3 On-off Test

To perform an On-off test, do the following:

1. Press the **R** key and **R** appears on the top of the screen.

2. Press the **SET** key until the following is shown on the screen. 

3. Insert the black lead into the **COM** banana jack input and the red lead into the **V/Ω/C** banana jack input.

4. Connect the red and black leads to the test point. If the resistance value of the tested point is less than 50Ω, you will hear beep sound from the test tool.

Now, you can see a screen that looks like the following figure 20.

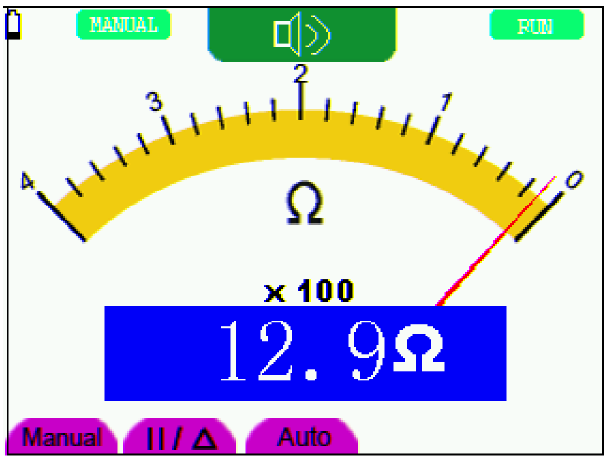


Figure 20: On-off Test

7.4.4 Measuring Capacitance

To measure a capacitance, do the following:

1. Press the **R** key and **R** appears on the top of the screen
2. Press the **SET** key until **C** appears at the top of the screen.
3. Insert the capacitance measurer of this multimeter to **COM** jack and **V/Ω/C** jack**.**
4. Insert the capacitance to the capacitance measurer, then screen shows the capacitance reading.

Notice: when measured value is less than 5 nF capacitance, please use relative value measuring mode to improve measuring precision. It will take about 30seconds if capacitance measurement is larger than 40uF.

Now, you can see a screen that looks like the following figure 21.

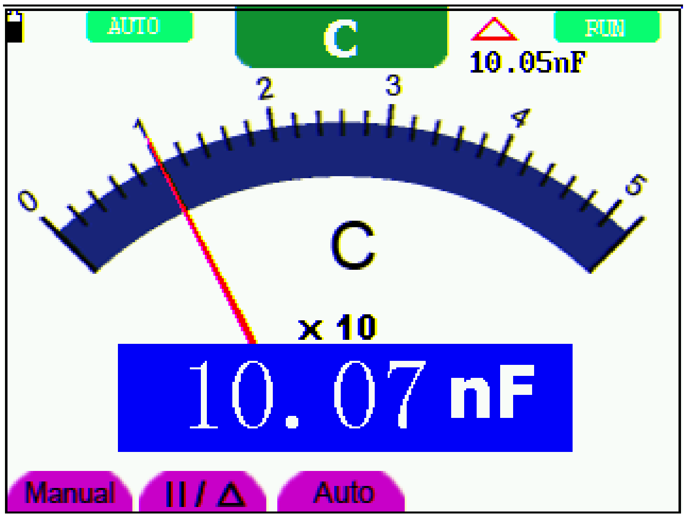


Figure 21: Capacitance Measurement

7.4.5 Measuring DC Voltage

To measure a DC voltage, do the following:

1. Press the **V** key and **DCV** appears at the top of the screen.
2. Insert the black lead into the **COM** banana jack input and the red lead into the **V/Ω/C** banana jack input.
3. Connect the red and black leads to the measured point and the measured point voltage value is displayed on the screen.

Now, you can see a screen that looks like the following figure 22.

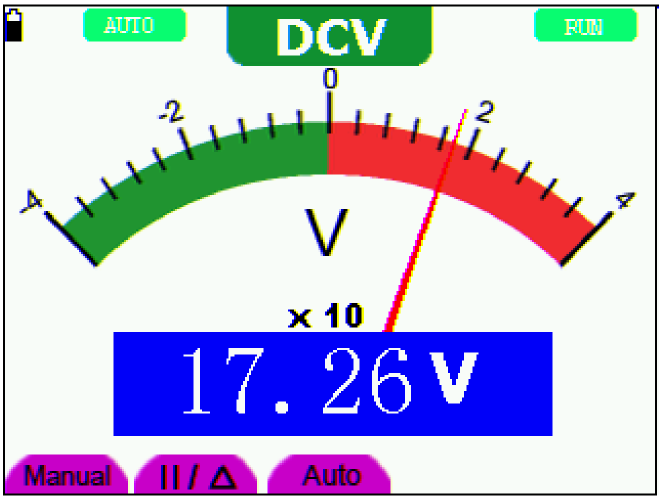


Figure 22: DC Voltage Measurement

7.4.6 Measuring AC Voltage

To measure the AC voltage, do the following:

1. Press the **V** key and **DCV** appears at the top of the screen.
2. Press the **SET** key and **ACV** appears at the top of the screen.
3. Insert the black lead into the **COM** banana jack input and the red lead into the **V/Ω/C** banana jack input.
4. Connect the red and black leads to the measured points and the AC voltage values of measured points will be displayed on the screen.

Look at the display; you can see a screen that looks like the following figure 23.

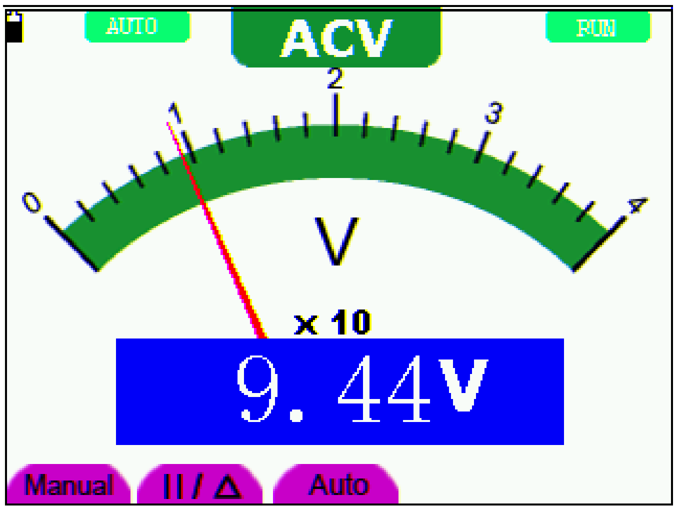


Figure 23: AC Voltage Measurement

7.4.7 Measuring DC Current

To measure a DC current which is less than 400 mA, do the following:

1. Press the **A** key and **DCA** appears at the top of the screen. The unit on the main reading screen is **mA. mA** and **10A** will display on the right bottom of screen, press **F4** and **F5** to switch the measurement between **mA** and **10A**. 400mA is acquiescently.
2. Insert the black lead into the **COM** banana jack input and the red lead into the **mA** banana jack input.
3. Connect the red and black leads to the measured points and the DC current values of measured points will be displayed on the screen.

Look at the display; you can see a screen that looks like the following figure 24.

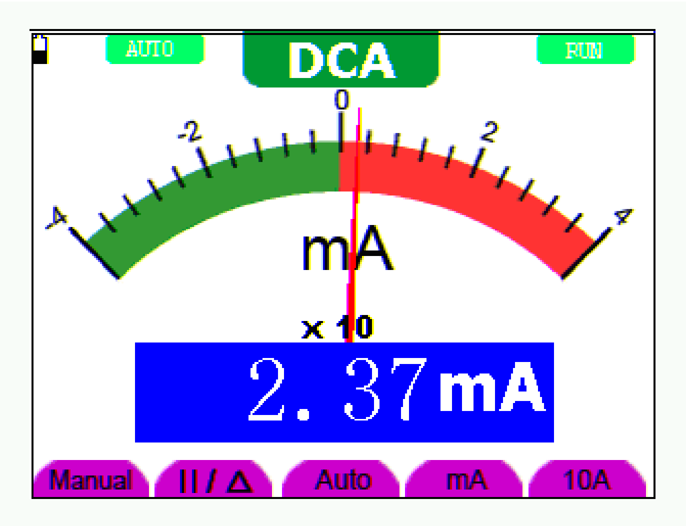


Figure 24: DC Current Measurement for 400 mA

To measure a DC current which is larger than 400 mA, do the following:

1. Press the **A** key and **DCA** appears at the top of the screen. The unit on the main reading screen is **mA**.
2. Press **F5** key change to **10A** measurement, the unit on the main reading screen is **A.**
3. Insert the black lead into the **COM** banana jack input and the red lead into the **10A** banana jack input.
4. Connect the red and black leads to the measured point and the **DC** current value of the measured point will be displayed on the screen.
5. Press **F4** return to 400 mA measure.

Look at the display; you can see a screen that looks like the following figure 25.

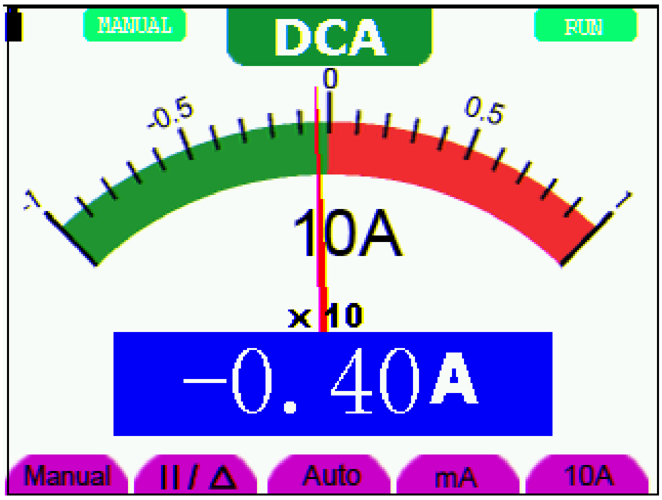


Figure 25: DC Current Measurement for 10A

7.4.8 Measuring AC Current

To measure an AC current which is less than 400 mA, do the following:

1. Press the **A** key and **DCA** appears at the top of the screen. The unit on the main reading screen is **mA. mA** and **10A** will display on the right bottom of screen, press **F4** and **F5** to switch the measurement between **mA** and **10A**. 400mA is acquiescently.
2. Press the **SET** key once and **ACA** is visible at the top of the screen.
3. Insert the black lead into the **COM** banana jack input and the red lead into the **mA** banana jack input.
4. Connect the red and black leads to the measured point and the **AC** current value of the measured point will be displayed on the screen.

Look at the display; you can see a screen that looks like the following figure 26.

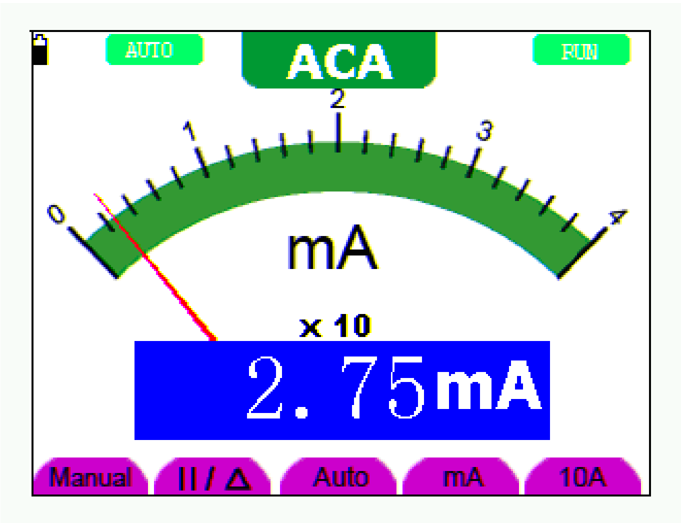


Figure 26: AC Current Measurement for 400 mA

To measure an AC current which is larger than 400 mA, do the following:

1. Press the **A** key, an instruction prompt you to plug the multimeter test leads in the right position. After check, press any key to enter into multimeter measure and **DCA** appears at the top of the screen. The unit on the main reading screen is **mA.**
2. Press the **SET** key once and **ACA** is visible at the top of the screen.
3. Press **F5** to select **10A** measure, the unit of main reading window is **A.**
4. Insert the black lead into the **COM** banana jack input and the red lead into the **10A** banana jack input.
5. Connect the red and black leads to the measured point and the **AC** current value of the measured point will be displayed on the screen.
6. Press **F4** return to 400mA measure.

Look at the display, you can see a screen that looks like the following figure 27.

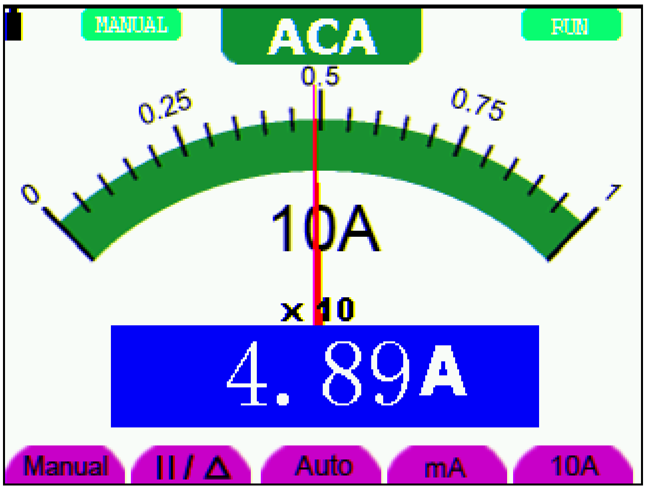


Figure 27: AC Current Measurement for 10A

7.5 Freezing the Readings

You can freeze the displayed readings at any time.

1. Press the **RUN /STOP** key to freeze the screen and **STOP** will be displayed at the top right of the screen.
2. Again, press the **RUN /STOP** key, you can resume your measurement.

Look at the display; you can see a screen that looks like the following figure 28.

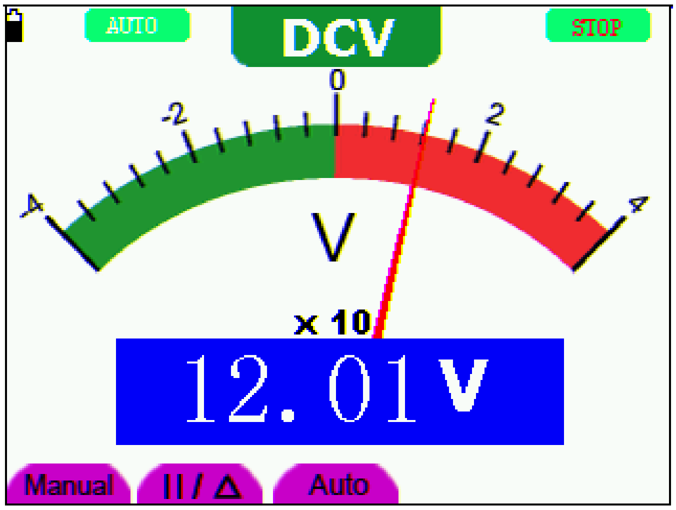


Figure 28: Freezing the Readings

7.6 Taking a Relative Measurement

A currently measured result relative to the defined reference value is displayed in a relative measurement.

The following example shows how to take a relative measurement. At first, it is required to acquire a reference value.

1. Press **R** key and **R** is displayed on the top side of the screen.
2. Press the **SET** key until **C** appears at the top of the screen.
3. Plug capacitance extended module in capacitance measure jack.
4. When the reading leveling off, press **F2** key and △ is displayed on the top side of the screen. The saved reference value is displayed below △.
5. Plug capacitance, the displayed major reading on the screen is actual the capacitance value.

Look at the display; you can see a screen that looks like the following figure 29.

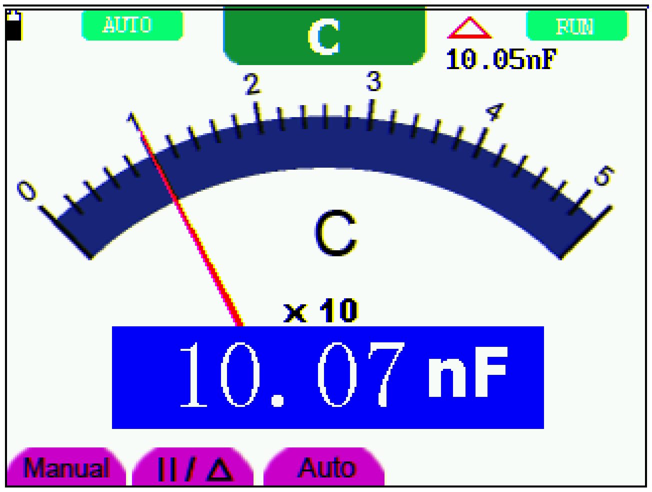


Figure 29: Relative Measurement

7.7 Selecting Automatic/ManualRange Adjustment

The defaulted range mode of the instrument is automatic range. To switch to the manual range, perform the following steps:

1. Press **F1** key and **MANUAL** is displayed on the top left side of the screen to enter the manual range mode.
2. Under the manual range mode, the measuring range is increased by a stage when pressing **F1** key each time, and when reaching the highest stage, it jumps to the lowest stage by pressing **F1** key once again. To multiply the reading of dial pointer by multiplying power and the unit of main reading on the screen will get the measurement result.
3. Press **F3** key and **AUTO** is displayed on the top left side of the screen to switch back to the automatic range mode.

Look at the display; you can see a screen that looks like the following figure 30.

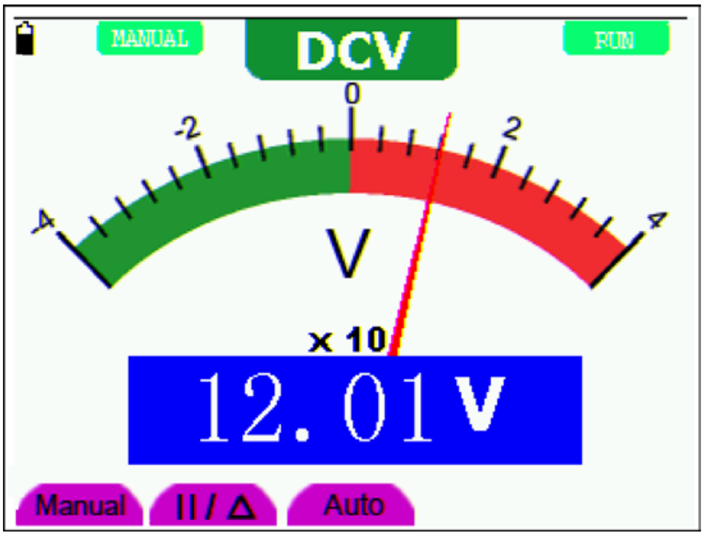


Figure 30: Automatic/Manual Range Adjustment

Attention: capacitance measurement without manual range mode.

8. Advanced Function of Oscilloscope

8.1 About this Chapter

This chapter will detail the oscilloscope function of the test tool.

8.2 Setting the Vertical Channel

Each channel has its own independent vertical menu and each item can be set respectively based on the specific channel.

To make vertical Channel settings, do the following:

1. Press the **MENU** key and the function menu appears at the right of the screen.
2. Press the **MENU ▲** or **MENU ▼** key to jump to **CH SETUP** and 4 options appears at the bottom of the screen.
3. Select key from **F1** to **F4** to make different settings.

Now, you can find a screen that looks like the following figure 31.

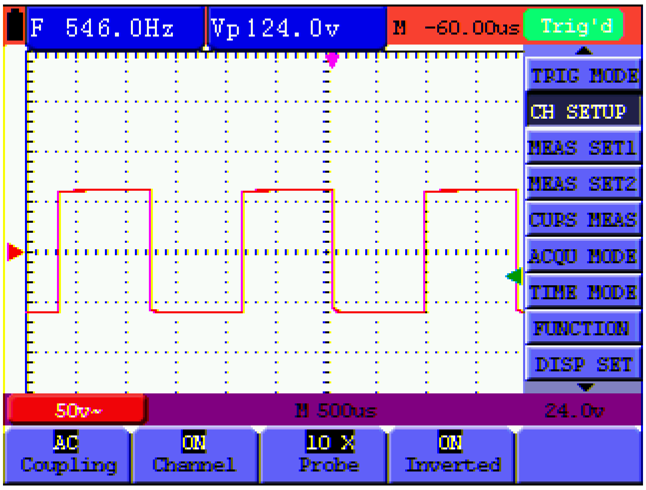


Figure 31: Setting the Vertical

The following Table describes the **Vertical Channel** menu:

Function menu	Setting	Description
Coupling	AC DC Ground	The dc component in the input signal is blocked. The ac and dc components of the input signal are allowed. Input signal is interrupted.
Channel	OFF ON	Close the channel. Open the channel.
Probe	1 X 10 X 100 X 1000 X	Select one according to the probe attenuation level to ensure a correct vertical scale reading.
Inverted	OFF ON	Waveform is displayed normally. Open the **Invert** function of the waveform setting.

8.2.1 Setting the Channel Coupling

Press **F1** key, set **Coupling** as **AC** to make an AC coupling setting. The DC component contained in the tested signal is blocked.

Press **F1** key, set **Coupling** as **DC** to make a DC coupling setting. Both DC and AC components contained in the tested signal are permitted.

Press **F1** key, set **Coupling** as **Ground** to make a Ground coupling setting. Input signal is interrupted.

The waveform is displayed as the following figure 32, figure 33, and figure 34.

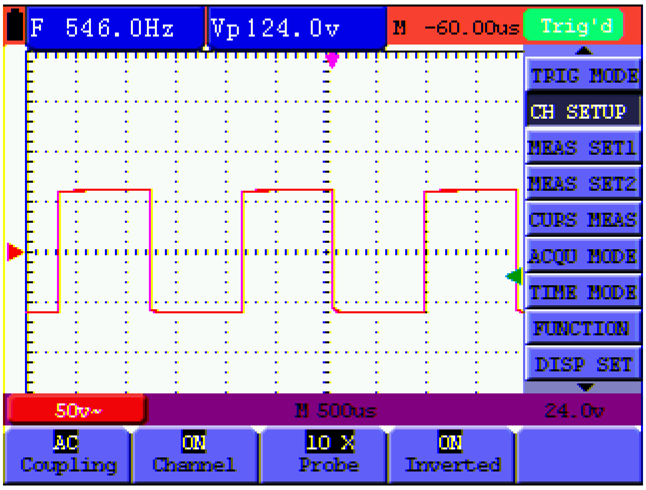


Figure 32: AC Coupling

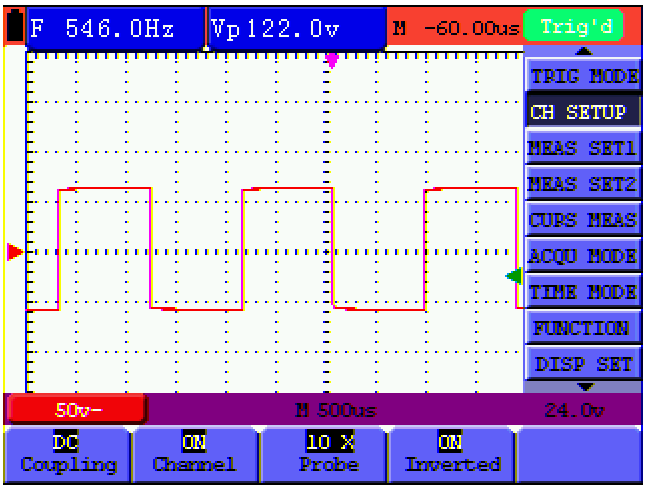


Figure 33: DC Coupling

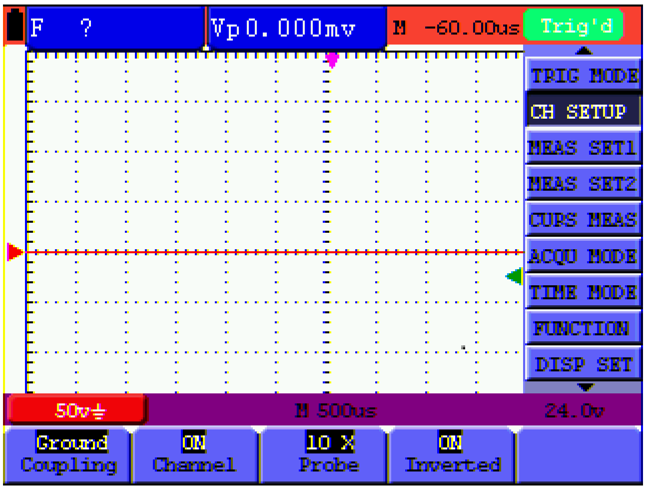


Figure 34: Ground Coupling

8.2.2 Open and Close Settings on Channel

Press **F2 Channel** key first, and then **OFF** to make a Close setting on channle.

Press **F2 Channel** key first, and then **ON** to make an Open setting on channle.

8.2.3 Setting the probe attenuation

To prevent excessive input voltage, we recommend you to set the probe attenuation level to the 10X position to prevent excessive voltage.

After attenuating the probe level by 10:1, you also need to magnify the display level by 10 X to match the displayed amplitude with the real amplitude.

Press **F3 Probe** to adjust the probe attenuation level.

Table: Probe attenuation level and the corresponding menu setting

Probe attenuation level	Corresponding Menu Setting
1:1	1 X
10:1	10 X
100:1	100 X
1000:1	1000 X

8.2.4 Setting of Inverted Waveform

Inverted waveform: The displayed signal reverses 180 degrees relatively to the ground potential.

Press **F4** to set **Inverted** as **ON** to start Invert; as **OFF** to close Invert.

8.3 Setting the Trigger System

The Trigger defines the time when the acquisition of data and display of waveform. If it is set correctly, the trigger can turn an unstable display into a significant waveform.

When starting the acquisition of data, the oscilloscope collects sufficient data to draw the waveform at the left side of the triggering point. With waiting for the triggering condition, the oscilloscope is gathering data continuously. After a trigger is detected, the oscilloscope gathers enough data continuously to draw the waveform at the right side of the triggering point.

To make a trigger mode setting, do the following:

1. Press the **MENU** key and the function menu appears at the right of the screen.
2. Press the **MENU ▲** or **MENU ▼** key to select **TRIG MODE** and five options are displayed at the bottom of the screen.
3. Select from **F1 to F5** key to make a different setting.
4. Press **OPTION** and left bottom display as below during edge trigger and video trigger:

◀/▶— Time	**◀/▶— Time Base**
▲/▼ — Trig	**▲/▼ — Trig**

5. Press ▲ (OPTION) or ▼ (OPTION) to adjust trigger vertical position, Press ◀ (OPTION) or ▶ (OPTION) to adjust time base horizontal position or adjust horizontal position.

8.4 Triggering Control

There are three trigger modes including Edge trigger and Video trigger . Each trigger mode is set by different function menu.

Edge trigger: The edge trigger type triggers on the incoming signal edge. Use the edge trigger for all signals except for video related ones.

Video trigger: Perform video field trigger or line trigger on the standard video signals.

The following describes Edge trigger and Video trigger menus respectively.

8.4.1 Edge Trigger

The Edge trigger is a mode by which trigger occurs at the triggering threshold value of the input signal edge. With the Edge trigger selected, the trigger happens on the rise or fall edge of the input signal, shown as the figure 35.

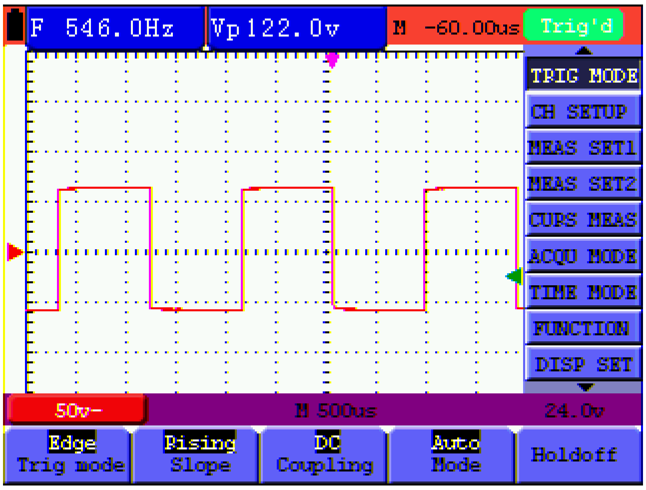


Figure 35: Edge Trigger

The Edge trigger menu is described in the following table.

Function menu	Settings	Description
Slope	Rising Falling	Triggering on the rise edge of the signal. Triggering on the fall edge of the signal.
Trig mode	Auto Normal Single	Acquisition of waveforms is possible even if there is no triggering condition detected. Acquisition of waveforms can only be done when the triggering condition is satisfied. Sampling on a waveform when one trigger is detected, and then stop sampling.
Coupling	AC DC	With this mode selected, the DC component is prevented from passing-though. All components are allowed.
Holdoff		To go to holdoff menu

8.4.2 Video Trigger

The video trigger type is designed to capture the video signal format, **NTSC, PAL** or **SECAM**. For any other signal type, use the edge trigger.

Figure 36 is the Video Odd Field Trigger. Figure 37 and figure 38 is the Video Line trigger.

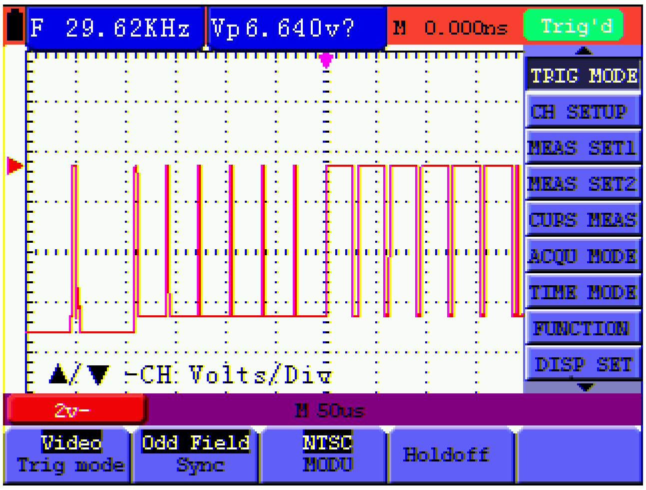
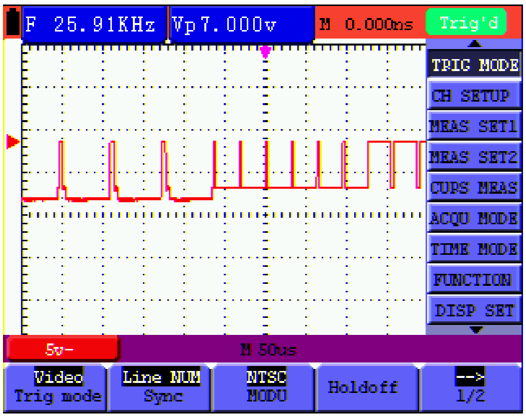


Figure 36: Video Odd Field Trigger



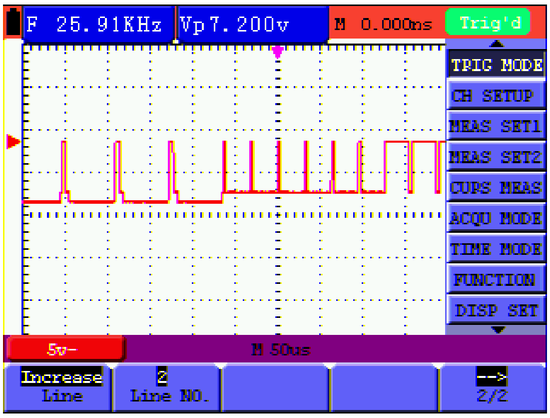


Figure 37: Video Designed Line trigger (Page1) Figure 38: Video Designed Line trigger (Page2)

The Video trigger menu is described in the following table (First page):

Function menu	**Settings**	**Description**
Sync	Line	Make a video line trigger synchronization setting.
	Field	Make a video field trigger synchronization setting.
	Odd Field	Make a video odd field trigger synchronization setting.
	Even Field	Make a video even field trigger synchronization setting.
	Line NUM	Make a video designed line synchronization setting.

MODU	NTSC PAL/SECAM	Video format setting
Holdoff		To go to holdoff menu
--> 1/2		Back to previous menu（When Sync selected as Line NUM）

2. when the sync is **Line NUM**, the second page menu is shown as bellow.

Line	Increase	Set the line value to increase

	Decrease	Set the line value to decrease
Line No.		Set and Show the line valve
--> 2/2		Back to previous menu

When you go to the holdoff menu, you can see a screen in the following figure 39.

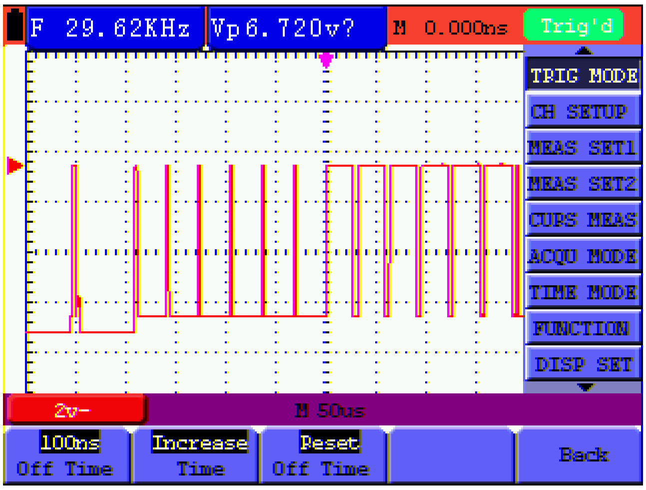


Figure 39: Trigger Holdoff

the **Holdoff** menu is described in the following table:

Function menu	**Settings**	**Description**
Off Time		Set time slot before another trigger event.
Time	Increase Decrease	Set the off time to increase. Set the off time to decrease.
Reset Off Time		Reset Holdoff time to100ns.
Back		Back to previous menu.

Note:

Trigger Holdoff can stabilize complex waveform, such as the pulse range. Holdoff time is the oscilloscope's waiting period before starting a new trigger. During Holdoff, oscilloscope will not trigger until Holdoff ends.

Term interpretation

Holdoff: Set time slot before another trigger event.

Trigger modes: There are three kinds of trigger modes available for this oscilloscope, they are, Auto (acquires signal continuously), Normal (acquires signal when trigger conditions are met) and Single (manually triggers the signal).

Automatic trigger mode: The oscilloscope can acquire the waveform without any triggering condition detected in this mode, in which it will be triggered compulsively when waiting for a specified period of time without any triggering condition ignited. When an invalid trigger is enforced， the oscilloscope can not keep the waveform in phase.

Normal trigger mode: In this mode, the oscilloscope cannot acquire the waveform until it is

triggered. When there is not any trigger, the oscilloscope will display the original waveform without new waveforms captured.

Single mode: In this mode, the oscilloscope will detect a trigger and capture a waveform at each time when the customer presses the RUN/STOP key.

8.5 Setting the Acquiring Mode

The **ACQU MODE** menu is described in the list shown as below.

Function menu	Settings	Description
Sample		The waveform data is sampled at an equal time interval. The sample mode accurately reconstructs the waveform, but cannot respond to rapid changes and sudden peaks.
Peak Detect		The maximum and minimum data in the sampling interval are picked up. The peak detect mode captures rapid changes and sudden peaks, but the waveform becomes noisy.
Average		Multiple samples are averaged together. The average mode reduces the noise level, but the waveform must be repetitive.
Averages	4, 16, 64 or 128	Select the average number.

8.6 Display Setting

The **DISP SET** menu is described in the following table.

Function menu	Settings	Description
Type	Vectors Dots	The vector drawing mode shows the waveform as a smooth line, connecting each data point. The dot drawing mode shows the waveform as a collection of independent data points.
Persist	OFF 1sec 2sec 5sec Infinite	The persistence setting sets how long the old waveforms remain in the display, useful for observing the waveform variations.
Carry	Bitmap Vectors	The data transmitted in communication are bitmaps. The data transmitted in communication are vectors.
Cymometer	ON OFF	to set up cymometer limit to "ON" status. to set up cymometer limit to "OFF" status.

8.6.1 Display Style

The display style includes **Vectors** and **Dots** displays, shown as the following figure 40, figure 41.

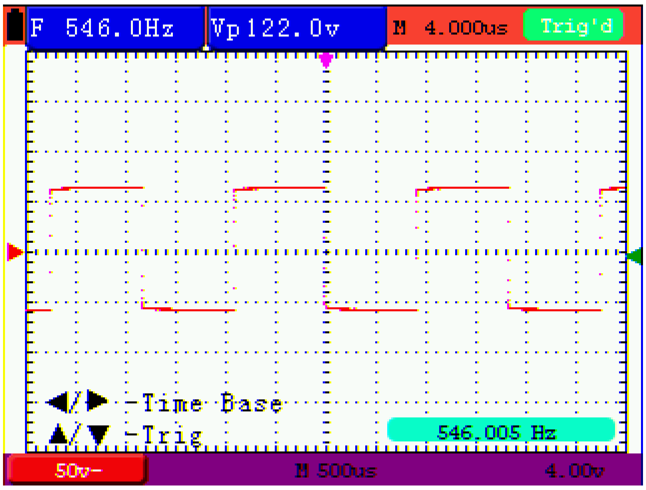


Figure 40: Dots Style

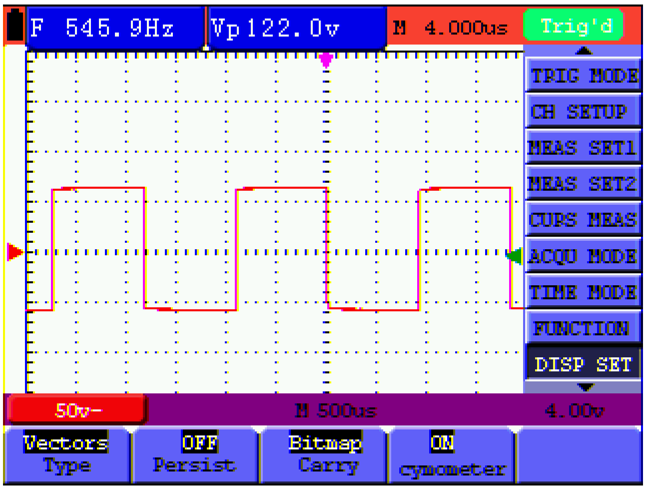


Figure 41: Vectors Style

8.6.2 Persistence

With **Persist** function selected, the displayed saved original data gradually decay in color and the new data are bright in color; with infinite persistence mode selected, the oscilloscope keeps all past traces of the displayed waveform.

8.6.3 Cymometer

It is a 6 digits cymometer. Its measurement range of frequency is 2Hz to full bandwidth.

Set up cymometer limit to "**ON**" status.

To make a cymometer setting, do the following:

If you want to measure frequency of the Channel, you can do as the follows:

1. Press **MENU**, the function menu will appear on the right of the screen.
2. Press **MENU ▲** or **MENU ▼** and choose **DISP SET**, five options will show at the bottom

of the screen.

3. Press **F4** and choose **ON**.

See the following figure 42:

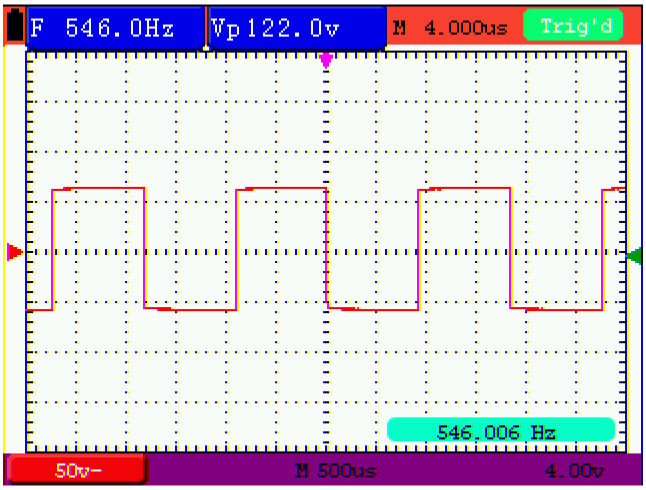


Figure 42 Cymometer

8.7 Waveform Saving Setups

The oscilloscope can save 4 waveforms, which can be displayed on the screen with the present waveform. The recalled waveform saved in the memory cannot be adjusted.

8.7.1 Waveform Saving Setups in normal mode

The **WAVE SAVE** menu is described in the following list.

Function menu	**Setups**	**Description**
WAVE	A, B, C and D	Select the address for saving or recalling a waveform.
Save		Store the waveform of a selected signal source into the selected address.
Show	ON OFF	Close or start displaying the waveforms stored in address A, B, C or D.

To save a waveform in address A, do the following:

1. Press the **MENU** key and the function menu appears at the right of the screen.

2. Press the **MENU** ▲ or **MENU** ▼ key to select the **WAVE SAVE**. Three options are displayed at the bottom of the screen.

3. Press the **F1** key to select the address **A**.

4. Press the **F2** key to save the waveform in address A.

To display the saved waveform on the screen, do the following:

6. Press the **F3** key to select **ON** for the address A. The waveform saved in address A will be displayed on the screen in green color.

The display color is green, and the zero point of waveform, voltage and time is purple

Now, you can see a screen that looks like the following figure 43.

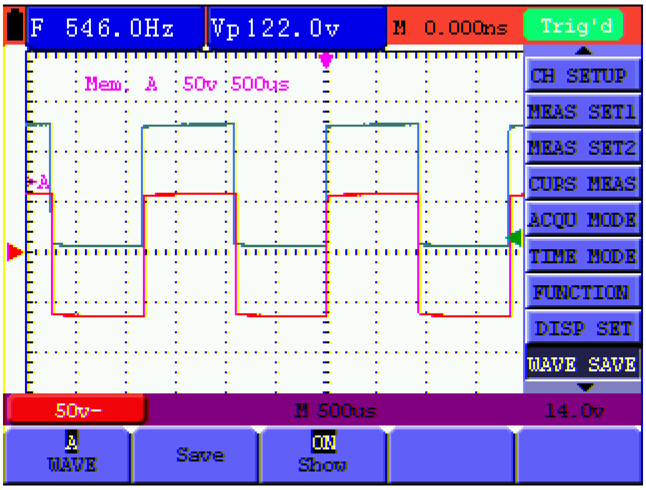


Figure 43: Waveform Saving

8.7.2 Waveform Saving Setups in FFT mode

FFT being on, the **WAVE SAVE** is described in the following list.

Function menu	Setups	Description
WAVE	A, B, C and D	Select the address for saving or recalling a waveform.
Save		Store the waveform of a selected signal source into the selected address.
Show	ON OFF	Close or start displaying the waveforms stored in address A, B, C or D.

To save a waveform in address A, do the following:

1. Press the **MENU** key and the function menu appears at the right of the screen.
2. Press the **MENU ▲** or **MENU ▼** key to select the **WAVE SAVE**. Three options are displayed at the bottom of the screen.
3. Press the **F1** key to select the address **A.**
4. Press the **F2** key to save the waveform in address A

To display the saved waveform on the screen, do the following:

5. Press the **F3** key to select **ON** for the address A. The waveform saved in address A will be displayed on the screen in green color and the zero point of waveform, Vamp and Freq is purple.

Now, you can see a screen that looks like the following figure44

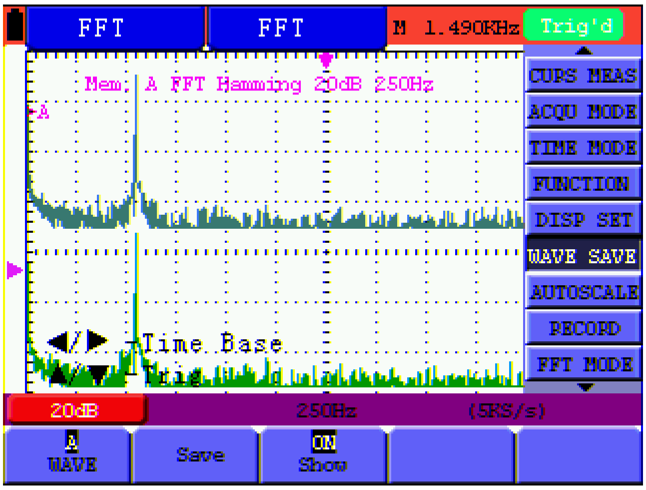


Figure 44: Waveform Saving in FFT Mode

8.8 Function Setting Menu

The **FUNCTION** menu is described in the following list.

Function menu	Setting	Description
Recall Factory		Resume the instrument to its factory settings.
Auto calibration		Perform the Auto-calibration procedure.
Language	Chinese English Other	Select the display language.

Auto-calibration

The Auto-calibration function automatically configures internal parameters to maintain the accuracy. Run the Auto-calibration in the following cases:

The temperature fluctuates more than 5 degrees Celsius during operations.

Operate the oscilloscope in a new bench top or field environment.

Procedure:

1. Press the **MENU** key and select the **FUNCTION** menu using **MENU** ▲ or **MENU** ▼ key.

2. Press **F2** (Auto calibration). A message appears on the display, asking you to remove all cables and probes from oscilloscope.

3. After removing all cables, press **F2** (Auto calibration) again. The Auto-calibration automatically starts and a message appears, showing that the calibration is ongoing.

To interrupt calibration, press any key during the calibration.

8.9 Making Automatic Measurements

The oscilloscope can perform 18 types automatic measurements such as frequency, cycle, average value, peak-to-peak value , root mean square value, Vmax, Vmin, Vtop, Vbase, Vamp, Overshoot, Preshoot, Rise Time, Fall Time, +Width, -Width, +Duty, -Duty; and gives two kinds of measurement results simultaneously on the screen.

The function menu for automatic measurements is described in the following list.

Function menu	Description
Freq	Measure the frequency of waveform.
Period	Measure the period of waveform.
Mean	Measure the average value of waveform.
PK-PK	Measure the peak-to-peak value of waveform.
Cyc RMS	Measure Root Mean Square (RMS) value of waveform.
Vmax	Measure the Vmax of waveform
Vmin	Measure the Vmin of waveform
Vtop	Measure the Vtop of waveform
Vbase	Measure the Vbase of waveform
Vamp	Measure the Vamp of waveform
Overshoot	Measure the Overshoot of waveform
Preshoot	Measure the Preshoot of waveform
Rise Time	Measure the Rise Time of waveform
Fall Time	Measure the Fall Time of waveform
+Width	Measure the +Width of waveform
-Width	Measure the -Width of waveform
+Duty	Measure the +Duty of waveform
-Duty	Measure the -Duty of waveform

To measure the frequency of waveform with **Measurement 1** and the peak-to-peak value of waveform with **Measurement 2**, do the following:

1. Press the **MENU** key and the function menu is shown at the right of the screen.
2. Press the **MENU ▲** or **MENU ▼** key to select **MEAS SET 1**. Four options appear at the bottom of the screen.
3. Press the **F1** key to select the frequency measurement**.** The measurement window on the screen shows the frequency of waveform.
4. Press the **MENU ▲** or **MENU ▼** key to select **MEAS SET 2**. Five options appear at the bottom of the screen.
5. Press the **F4** key to jump to the **PK-PK** measurement. The measurement window on the screen shows the peak-to-peak value of waveform.

Now, you can see a screen that looks like the following figure 45.

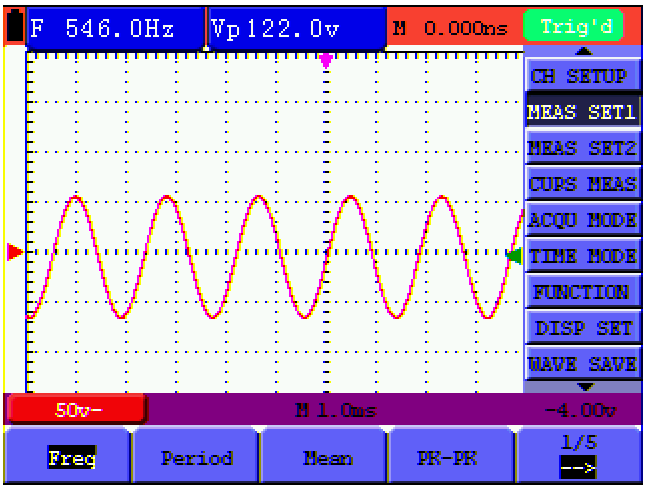


Figure 45: Automatic Measurements

8.10 Setting the Cursor Measurements

This oscilloscope allows you to make manual cursor measurements on time and voltage.

8.10.1 Setting the cursor measurement in normal mode

The cursor measurement menus are listed and described in the following table.

Function menus	Settings	Description
Type	OFF Voltage Time	Close the cursor measurement. Display the voltage measurement cursor and menu. Display the time measurement cursor and menu.
Delta		Display the difference of measured value between the two channels
Cur1		Display the relating measured value of Cursor 1
Cur2		Display the relating measured value of Cursor 2

To make a voltage measurement, doing the following:

1. Press the **MENU** key and the function menus are displayed at the right of the screen.
2. Press the **MENU ▲** or **MENU ▼** key to select **CURS MEAS**. Five options are shown at the bottom of the screen.
3. Press **F1** key to select the measurement type **Voltage**. Two purple crossing dashed lines V1 and V2 are shown on the screen.
4. Press **OPTION** and display as

◀/▶—Cursor 1

▲/▼—Cursor 2

When setting **OPTION ▲** or **OPTION ▼,** V2 will move up and down and the relating voltage value to the zero position of Channel 1 will show at the bottom of the screen. Setting **OPTION ◀** or **OPTION ▶,** V1 will move up and down and the relating voltage value to the zero position of Channel 1 will show at the bottom of the screen, at the same time the increment shows the absolute value of V1-V2 shown as Fig 46:

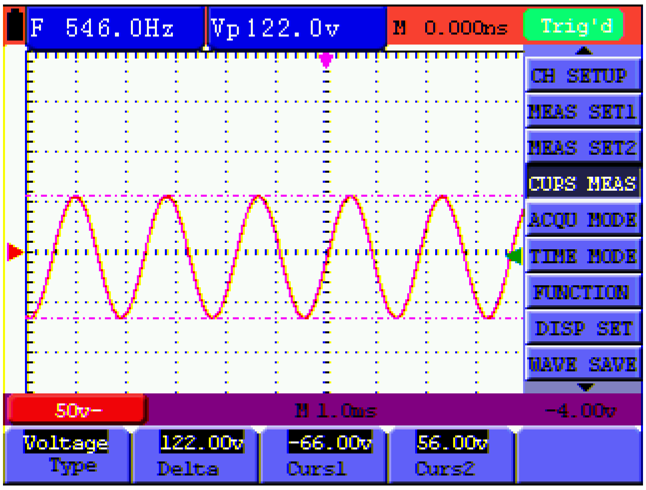


Figure 46: Use the Cursor for a Voltage Measurement

When log out submenu, every value will show on the right bottom of the screen as figure 47:

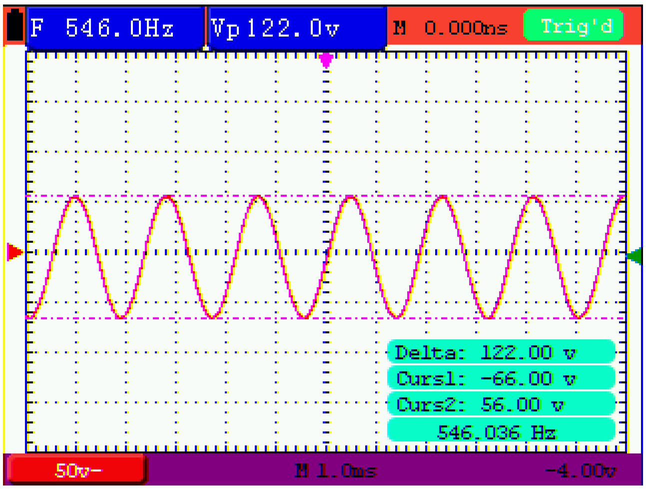


Figure 47

To use the cursor for a time measurement, do the following:

1. Press the **MENU** key and the function menus are displayed at the right of the screen.
2. Press the **MENU** ▲ or **MENU** ▼ key to select **CURS MEAS**.

3. Press the **F1** key to select the measurement type as **Time.** Two vertical dashed lines T1 and T2 appear on the screen.

4. Press **OPTION** and display as

◀/▶—Cursor 1

▲/▼—Cursor 2

Press ▲(OPTION) or ▼(OPTION) and see T1 move left and right and LCD display the time value match T1 to point position in panel; press ◀(OPTION) or ▶(OPTION) and see T2 move left and right and LCD display the time value match T2 to point position in panel.

Now, you can see a screen that looks like the following figure 48.

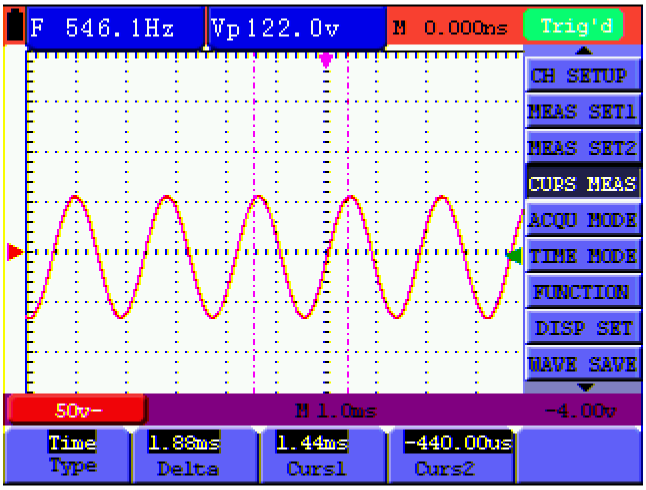


Figure 48: Cursor time measurement

When log out submenu, every value will show on the right bottom of the screen as figure 49:

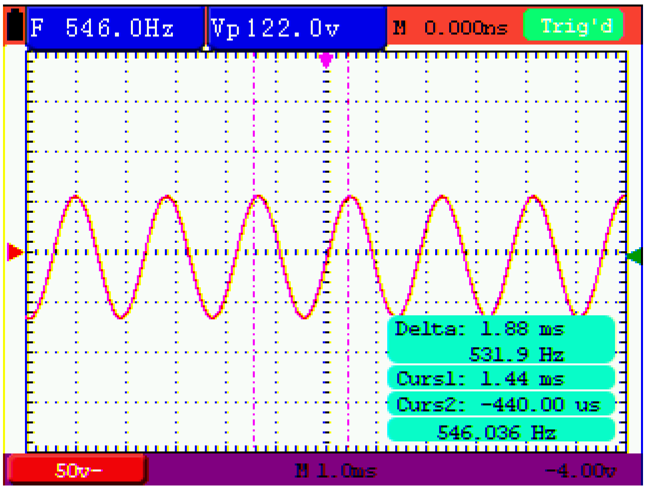


Figure 49: Use the Cursor for a Time Measurement

8.10.2 Setting the cursor measurement in FFT mode

FFT being on, the cursor measurement menus are listed and described in the following table.

Function menus	Settings	Description
Type	OFF Range Frequency	Close the cursor measurement. Display the vamp measurement cursor and menu. Display the freq measurement cursor and menu.
Delta		Display the difference of measured value between the two channels
Curs1		Display the relating measured value of Cursor 1
Curs2		Display the relating measured value of Cursor 2

To make a range measurement, doing the following:

1. Press the **MENU** key and the function menus are displayed at the right of the screen.
2. Press the **MENU** ▲ or **MENU** ▼ key to select **CURS MEAS**. Five options are shown at the bottom of the screen.
3. Press **F1** key to select the measurement type **Range.** Two purple crossing dashed lines V1 and V2 are shown on the screen.
4. Press **OPTION** and display as

◀/▶—Cursor 1

▲/▼—Cursor 2

Press ▲ (OPTION) or ▼ (OPTION) to see V1 move up and down and the panel will display the voltage value match V1 and Channel 1 Zero; Press ◄ (OPTION) or ► (OPTION) to see V2 move up and down and panel will display the voltage value match V2 to Channel 1 Zero. LCD panel also display the absolute value of V1-V2.

Now, you can see a screen that looks like the following figure 50.

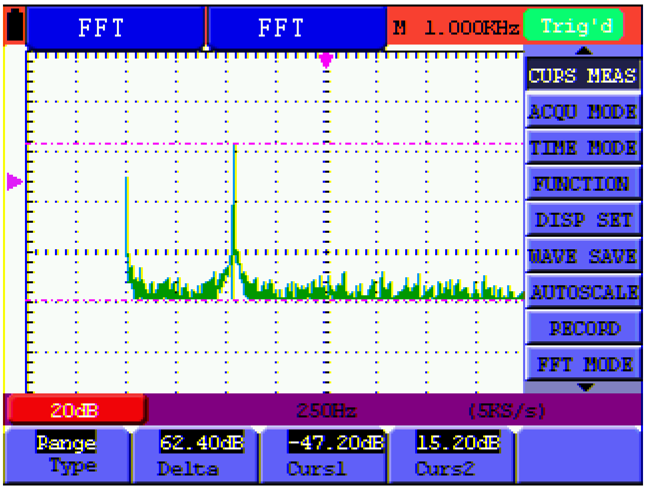
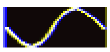
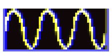


Figure 50: Cursor range measurement

8.11 Autoscale

The function is applied to follow-up signals automatically even if the signals change at any time. Autoscale enables the instrument to set up trigger mode, voltage division and time scale automatically according to the type, amplitude and frequency of the signals.

The menu is as follows:

Function menus	Settings	Description
Autoscale	OFF ON	Turn off Autoscale Turn on Autoscale
Mode	Horizontal Vertical HORI—VERT	Only adjust vertical scale according to input signal. Only adjust horizontal scale according to input signal. Adjust both vertical and horizontal scales according to input signal.
	 	Display only one or two cycles in waveform. Display Multi-cycles in waveform.

If you want to measure voltage of Channel 1, you can do as the follows:

1. Press **MENU**, the function menu will appear on the right of the screen.
2. Press **MENU ▲** or **MENU ▼** and choose **AUTOSCALE,** three options will show at the bottom of the screen.
3. Press **F1** and choose **ON.**

4. Press **F2** and choose **HORI -VERT**.

5. Press **F3** and  displays on the screen as figure 51:

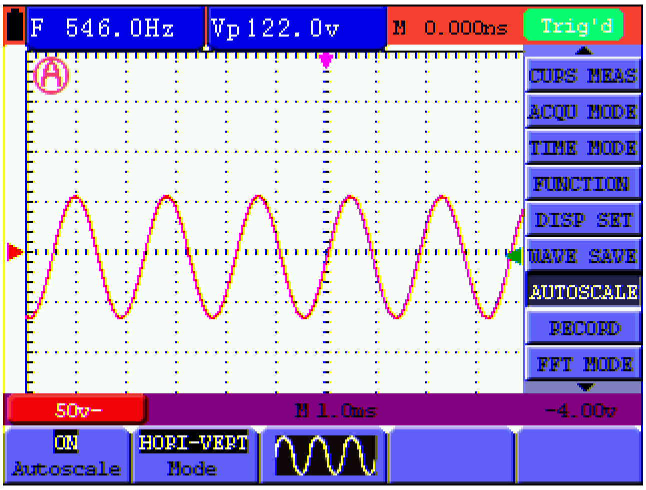


Figure 51: Autoscale Horizontal- Vertical multi-period waveforms

Note: Things you should be ware when turning on Autoscale.

1. The symbol  is flickering on the top left corner of screen every half second.
2. The oscilloscope is setting Triggers automatically for the incoming signal based on its best approach. Access from front panel to trigger controls is disabled. A warning message will be displayed on the bottom left corner of the screen when trying to change submenus of Trigger controls.
3. Oscilloscope is set as DC coupling with AUTO Triggering. A warning message is displayed when trying to change these settings.
4. The oscilloscope will turn off Autoscale if user is trying to adjust vertical position, voltage division, trigger level or time scale. To back to Autoscale, Press AUTOSET.
5. The oscilloscope is always on main time base.
6. The oscilloscope is turned into Peak Detection mode if it is in Average mode.
7. When video triggering, the horizontal time scale is 50us. If one channel is showing edge signal, the other channel is showing video one, the time scale refers to 50us as video one as standard.

8.12 Record

Waveform record: The function provides you to set the time interval between the frames and record the waveform up to 1000 numbers and get the better analysis effect more than before

through Playback and Save functions.
Four record modes: **Record**, **Play back**, **Storage**, **OFF**.

Record: Record the waveforms up until the set number of frames at specified time intervals.

Record menu list:

Menu	**Setting**	**Instruction**
Mode	Record Play back Storage OFF	Select record mode. Select play back mode. Select storage mode. Turn off all recorder functions.
End frame	1-1000	Set number of record frames.
Operate	Play Stop	Press to start recording. Press to stop recording.
Interval	1 ms - 1000 s	Set time interval between record frames.
--> 1/2		To next menu
Refreshed	ON OFF	The waveforms are in the state of refreshing when recording. The waveforms stop refreshing when recording.
Direction	Increase Decrease	The value increases from that of end frame to time interval The value decreases from that of end frame to time interval
--> 1/2		Back to previous menu.

Note: Both the waveforms are recorded at record mode. If one channel is off when recording, the channel data is not available at Playback mode.

Play back: Play back the recorded waveforms.
Play back menu list:

Menu	**Setting**	**Instruction**
Play mode	Loop Single	Set repeat play mode. Set single time play mode.
Operate	Play Stop	Press to start playback. Press to stop playing.
Interval	1ms-20s	Set up interval value between frames.

--> 1/2		To next menu
Start Frame	1-1000	Set start frame.
Cur frame	1-1000	Select current frame to be played.
End frame	1-1000	Set End frame.
Direction	Increase Decrease	The value increases at the mode of setting start frame, cur frame and end frame The value decreases at the mode of setting start frame, cur frame and end frame
--> 2/2		Back to previous menu (Only when Sync is set as Line NUM).

Note: the **Run/Stop** button can also replay or continue the waveform display.

Storage: Store recorded waveforms in non-volatile memory according to the setup frames.
Storage menu list：

Menu	**Setting**	**Instruction**
Start Frame	1-1000	Set first frame to be saved.
End frame	1-1000	Set last frame to be saved.
Direction	Increase Decrease	The value increases from the set start frame to the end frame The value decreases from the set start frame to the end frame
--> 1/2		To next menu
Save		Save recorded waveform to internal memory location.
Load		Recall recorded waveform from internal memory location.
--> 2/2		Back to previous menu.

Record the waveform as follows:

1. Press the **MENU** key and the function menu appears at the right of the screen.
2. Press the **MENU ▲** or **MENU ▼** key to select **RECORD** and five options are displayed at the bottom of the screen.
3. Press the **F1** key to select the **Record** mode.
4. Press **F2** and set the **End frame** at 300 (select the direction as Increase or Decrease in the second menu before step4).
5. Press **F4** and set the time **Interval** to **1.00ms**.
6. Press **F5** to enter into the second menu.

7. Press **F1** and select **OFF** to stop refreshing waveforms.

8. Press **F5** to back up to the first menu.

9. Press **F3** and select **Play** to operate.

Shown as Fig.52 and Fig.53

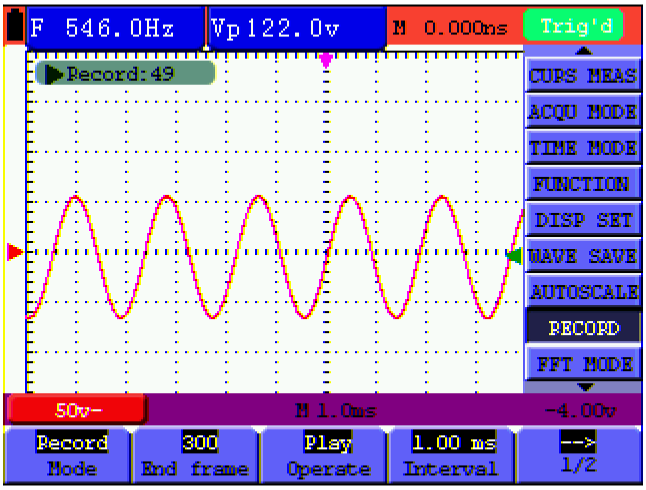


Fig.52： the first page of the record

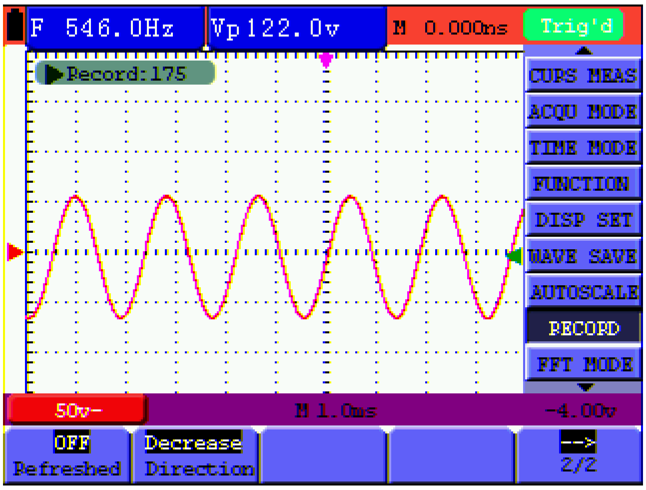


Fig.53: the second page of the record

8.13 Using FFT

An FFT breaks down signals into component frequencies, which the oscilloscope uses to display a graph of the frequency domain of a signal, as opposed to the oscilloscope's standard time domain graph. You can match these frequencies with known system frequencies, such as system clocks, oscillators, or power supplies.

FFT in this oscilloscope can transform 2048 points of the time-domain signal into its frequency

components and the final frequency contains 1024 points ranging from 0Hz to Nyquist frequency.

The following table describes the FFT menu:

Function Menu	Setting	Instruction
FFT	ON OFF	Turn on FFT function Turn off FFT function
Window	Rectangle Blackman Hanning Hamming	Select window for FFT.
Format	dB Vrms	Set Vrms as vertical scale unit Set dBVrms as vertical scale unit
Zoom	×1 ×2 ×5 ×10	Set multiple ×1 Set multiple ×2 Set multiple ×5 Set multiple ×10

Taking the FFT operation for example, the operation steps are as follows:

1. Press **MENU** key and the function menu appear on the right side of the screen.
2. Press **MENU ▲** or **MENU ▼** key to select **FFT MODE**. Five items selectable are available at the bottom of the screen.
3. Press **F1** to set **ON**. The green waveform F is shown in the screen after calculation.
4. Press **F2** to switch over **Window** including **Hamming, Rectangle, Blackman** and **Hanning**.
5. Press **F3** to switch over Format **dB** and **Vrms.**
6. Press **F4** to zoom in or out the waveform, the magnification includes ×1, ×2, ×5, ×10.
7. Press **CHANNEL SETTING (red)** ,
   - One of the following three prompts circularly will show at the bottom-left of the screen when the format is **dB**.

     ▲/▼— CH Volts/Div

     ▲/▼ — FFT dB Scale

- If left bottom of the screen displays "▲/▼**—FFT dB Scale** ", press ✚ **(red)** and ▬ **(red)** button to adjust dB value of each DIV, including **1dB**, **2dB**, **5dB**, **10dB**, **20dB;**
- If left bottom of the screen displays "▲/▼**—CH Volts/Div** " , press ✚ **(red)** and ▬ **(red)** button to adjust voltage of channel, and " **2v~** "shows in left bottom of the screen;
- If left bottom of the screen displays "▲/▼**—FFT Zero**", press ▲ **(red)** and ▼ **(red)** button to adjust the position of the waveform along the vertical position such as "**FFT 1.20 divs**".

8. Press **OPTION**, the following prompts shows on the left bottom on the screen.

   ◀/▶— Time Base

   ▲/▼— Trig

   Or

   ◀/▶— Time

   ▲/▼— Trig

   When "**◀/▶— Time**" is displayed, press **OPTION ◀ and OPTION ▶** menu button to adjust the position of the waveform along the horizontal position. "**FFT -2.00divs**" shown on the left bottom means the section start of the waveform departures from the Origin for 2.00DIV. The shown frequency of M is the exact frequency of the cursor point in the middle of spectrum. Shown as Figure.54.

   When "**◀/▶— Time Base**" is displayed, press **OPTION ◀ and OPTION ▶** to adjust horizontal base on horizontal base, such as "**250 Hz （5 kS/s）**" will be shown on the bottom status bar.

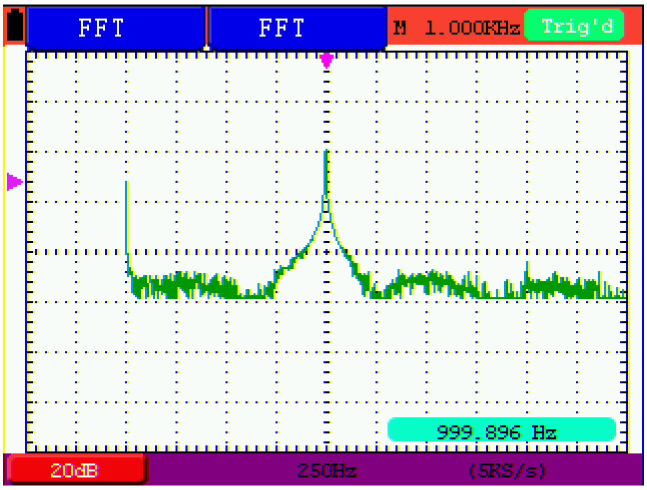


Figure 54 The Shown Frequency of M

Selecting an FFT Window

■ The FFT feature provides four windows. Each is a trade-off between frequency resolution and magnitude accuracy. What you want to measure and your source signal characteristics help determine which window to use. Use the following guidelines to select the best window.

Type	Description	Window
Rectangle	This is the best type of window for resolving frequencies that are very close to the same value but worst for accurately measuring the amplitude of those frequencies. It is the best type for measuring the frequency spectrum of nonrepetitive signals and measuring frequency components near DC. Use rectangle for measuring transients or bursts where the signal level before and after the event are nearly equal. Also, use this window for equal-amplitude sine waves with frequencies that are very close and for broadband random noise with a relatively slow varying spectrum.	
Hamming	This is a very good window for resolving frequencies that are very close to the same value with somewhat improved amplitude accuracy over the rectangle window. It has a slightly better frequency resolution than the Hanning. Use Hamming for measuring sine, periodic and narrow band random noise. This window works on transients or bursts where the signal levels before and after the event are significantly different.	

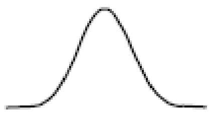
Hanning	This is a very good window for measuring amplitude accuracy but less so for resolving frequencies. Use Hanning for measuring sine, periodic and narrow band random noise. This window works on transients or bursts where the signal levels before and after the event are significantly different.	
Blackman	This is the best window for measuring the amplitude of frequencies but worst at resolving frequencies. Use Blackman-Harris for measuring predominantly single frequency waveforms to look for higher order harmonics.	

Fig55, 56, 57, 58 show four kinds of window function referring to sine wave of 1 kHz.

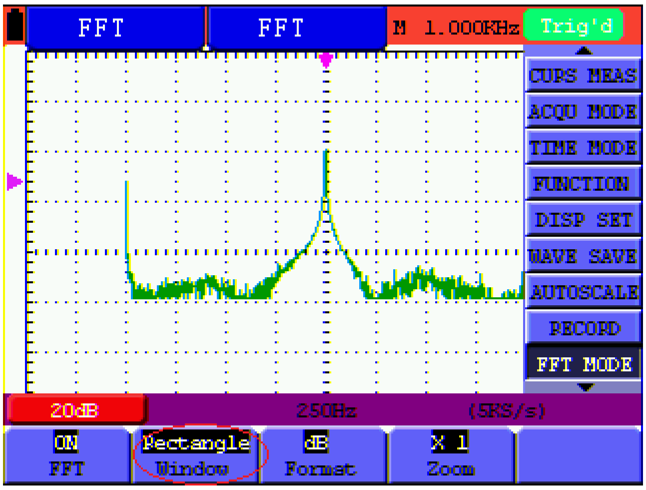


Fig 55: Rectangle window

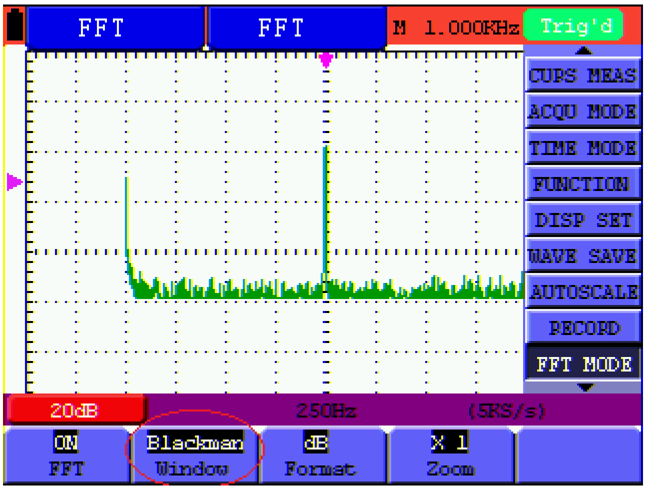


Fig 56: Blackman window

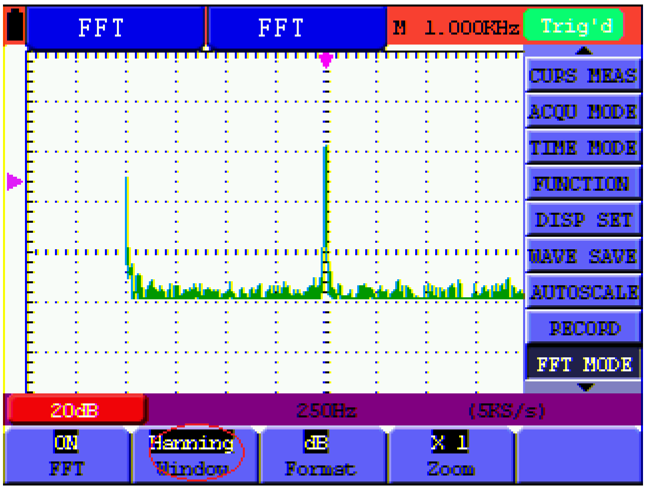


Fig.57. Hanning window

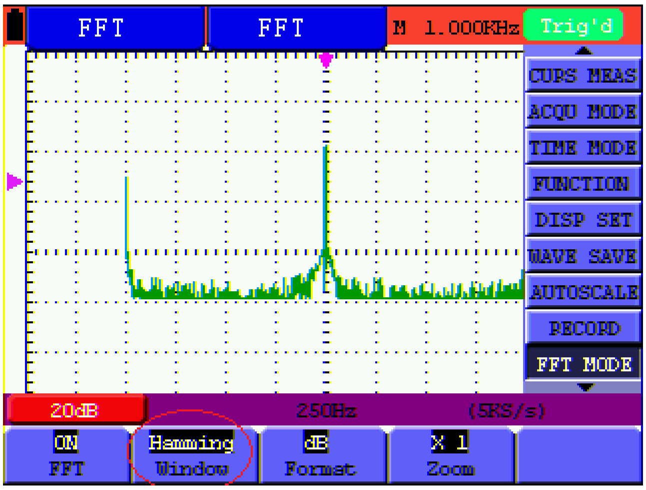


Fig.58. Hamming window

Quick Tips

- If desired, use the zoom feature to magnify the FFT waveform.
- Use the default **dB** scale to see a detailed view of multiple frequencies, even if they have very different amplitudes. Use the **Vrms** scale to see an overall view of how all frequencies compare to each other.
- Signals that have a DC component or offset can cause incorrect FFT waveform component magnitude values. To minimize the DC component, choose **AC** Coupling on the source signal.
- To reduce random noise and aliased components in repetitive or single-shot events, set the oscilloscope acquisition mode to average.

Term interpretation

Nyquist frequency: The highest frequency that any Real Time Digital Oscilloscope can measure

is exactly half of the sampling rate under the condition of no mistakes, which is called Nyquist frequency. If under-sampling occurs when the frequency sampled is higher than Nyquist frequency, "False Wave" phenomenon will appear. So pay more attention to the relation between the frequency being sampled and measured.

NOTE:

While FFT mode is turned on, **DO NOT USE THESE SETTINGS:**

1) Horizontal window setting.
2) Trigger control "SET 50%"
3) Auto-scale function
4) Wave record;
5) Measure 1 and Measure 2.

8.14 System State Menu

The system state menu is used to display information about the present horizontal system, vertical system, trigger system and others. The operation steps are shown as below.

1. Press the **MENU** key and the function menu is displayed at the right of the screen.
2. Press the **MENU ▲** or **MENU ▼** key to select the **SYS STAT.** Four options appear at the bottom of the screen.
3. Sequentially press **F1** to **F4** key and the corresponding state information will be shown on the screen.
4. The screen that looks like the following figure 59 will be displayed.

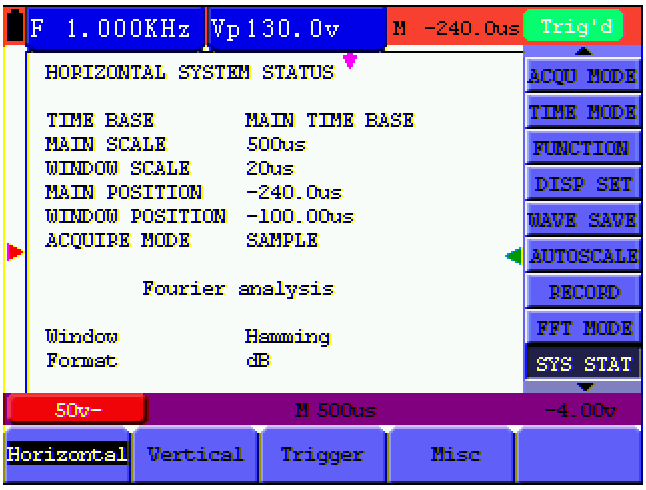


Figure 59: System State

8.14.1 Real time clock

Function: Be synchronous with the U disk storage time.

Do below steps to set up the real time clock:

1. Press **MENU** key and the function menu is displayed on the right side of the screen.
2. Press **MENU ▲** or **MENU ▼** key and select **SYS STAT** and there will be 4 items displayed at the bottom of the screen.
3. Press **F4** key and select **Misc** to display the system time, see Fig.60.

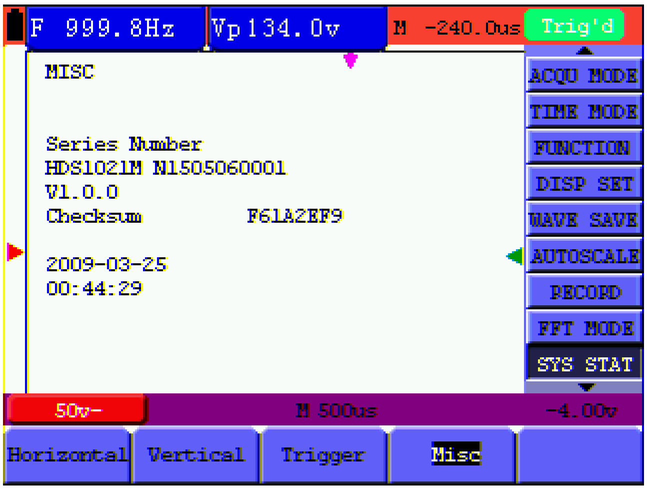


Fig.60: System Time

4. Press **OPTION** to enter into timing mode and if that the background color of the year, month, date, hour, minute, second which are in need of correct be deepened, the value can be adjusted.

5. Press **OPTION▲** or **OPTION▼** to change the corresponding value of the year, month, date, hour, minute and second effectively.

6. Press **OPTION ◄** or **OPTION ►** to switch to the year, month, date, hour, minute and second that are in need of adjustment.

7. Press **OPTION** to enter into normal time mode after timing.

8. If need to timing, please kindly repeat the above steps.

Note: The digital clock stops working when in time calculating mode.

8.15 Setting of Time Base Mode

The time base mode menu is explained as the following table.

Function menu	Setting	Explanation
Main TimeBase		Horizontal main time base is used to wave display
Zone Window		Use two cursors to define a window area
Window		Expand the defined window to full-screen display

For the operation of window extension, please execute the following steps:

1. Press **MENU** key, display the function menu on the right side of the screen.
2. Press **MENU** ▲ or **MENU** ▼ key to select **TIME MODE**, display three options at the bottom.
3. Press **F2** key to select **Zone Window**.
4. Press **OPTION** key to pop up **TIME BASE**, at this time, then press ◄ **(**OPTION**)** and ► **(**OPTION**)** key to adjust the time base window area defined by two cursors, the window size will vary.
5. Press **OPTION** key and call **TIME**, at this time, press ◄**(** OPTION**)** and ►**(** OPTION**)** to adjust the window position defined by two cursors, the window position is the time difference of the window center to main time base's horizontal pointer.
6. Press **F3** key, select **Window**, the defined window extends into the full-screen display.

The screen that looks like the following figure 61, 62 will be displayed.

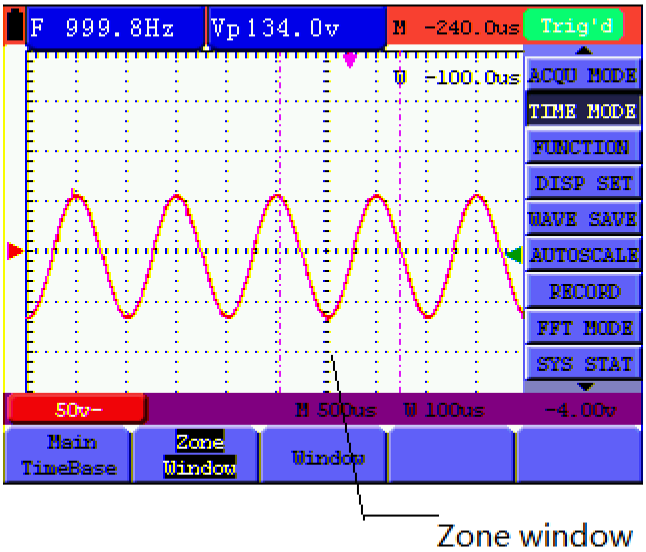


Figure 61: Zone Window

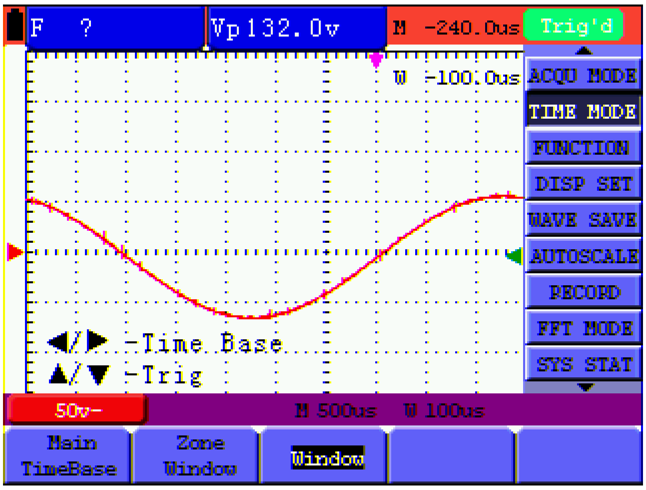


Figure 62: Window

8.16 Data Transmission

For the operation of data transmission, please execute the following steps:

1. Press **MENU** key, display the function menu on the right side of the screen.
2. Press **MENU** ▲ or **MENU** ▼ key to select **DISP SET**.
3. Press **F4** key, select the **Bitmap** or **Vectors** for data transmission.
4. Use a data line to connect the oscilloscope and the PC.
5. Open the OWON software that had been installed completely.
6. Setting the parameter under the use's manual, and then starts data transmission.

9. Trouble Shooting

1. The oscilloscope does not power up

It may be caused by the dead battery. At this time, the oscilloscope will not start even if it is powered by the battery charger. Firstly, charge the battery and supply the oscilloscope with power through the battery charger. However, don't switch on the oscilloscope until waiting for 15 minutes. If the oscilloscope still cannot start, please contact OWON for service.

2. The oscilloscope stops working only after operating for several seconds

Probably the battery is dead; Check the battery symbol at the upper left of the screen. The symbol indicates that the battery has been run out of power and must be charged.

3. The measurement type displays ERR when you switch to the Multimeter mode.

Probably you do not select the measuring mode. In this case, push down any key of the three keys A, V or R. Thus, the relative measuring mode will be shown on the screen. If the ERR is still displayed, restart the oscilloscope.

4. The measured voltage amplitude value is 10 times larger or smaller than the real value under the oscilloscope mode.

Check whether the channel attenuation level matches the actual probe attenuation ratio.

5. The waveform is displayed on the screen but is not stable under the oscilloscope mode.

- Check whether the signal item in the trigger mode menu matches the actually used signal channel.
- Check on the trigger mode: The edge trigger mode is applicable to the universal single and the video trigger mode applicable to the video signal. Only when the proper trigger mode is applied, can the waveform be in stable.
- Try to change the trigger coupling into the HF rejection and LF rejection to filter the HF or LF noise trigger by the interference. (Only for the models that have this function.)

6. There is no display on the screen when you push down RUN/STOP key under the oscilloscope mode.

Check whether the trigger mode in the trigger mode menu is in normal or single shot and whether the trigger level is out of the waveform range.

In such condition, adjust and make the trigger level in the middle or select the non-auto trigger mode. Additionally, press the **AUTO SET** key and complete the above setting

7. When select the average sampling in the sampling mode or select a longer display time in the display mode under the oscilloscope, the display speed is slow.

It is normal in the above case.

10. Appendix

10.1 Appendix A: Specifications

10.1.1 Oscilloscope

Only if other instructions are provided, are all technical specifications applicable to the probe with the 10X attenuation switch setting and the HDS-N series digital type oscilloscope. In order to be up to these specifications, the oscilloscope should meet the following requirement.

- The instrument should operate continuously for more than 30 minutes under the specified operating temperature.
- If the operating temperature is up to or larger than 5 Celsius degrees, the system function menu must be opened to make the system perform a "Auto- calibration" procedure (see "calibration" on P51).

Except those specifications marked with the word **Typical**, all specifications can be up to.

Sampling

Sampling modes	Normal sampling Peak detection Average value	
Sampling rate	HDS1021M-N	Max 500 MS/s
	HDS2061M-N	Max 500 MS/s
	HDS3101M-N	Max 1 GS/s

Input

Input coupling	DC, AC, Ground	
Input impedance	HDS1021M-N HDS2061M-N	1 MΩ±2% connected in parallel with 20 pF±5 pF
	HDS3101M-N	1 MΩ±2% connected in parallel with 15 pF±5 pF
Probe attenuation coefficient	1X, 10X, 100X, 1000X	
Max. Input voltage	400 V (peak)	
Channel delay time（typical）	150 ps	

Horizontal

Sampling rate range	HDS1021M-N	0.25 S/s - 500 MS/s
	HDS2061M-N	0.25 S/s - 500 MS/s

	HDS3101M-N	0.25 S/s - 1 GS/s
Waveform interpolation	（sin x）/x	
Record length	24k points on each channel	
Scanning speed range（S/div）	HDS1021M-N HDS2061M-N HDS3101M-N	5ns/div - 100s/div, stepping in the "1-2-5" mode
Sampling rate and delay time accuracy	±100ppm (any time interval which is equal to or larger than 1ms)	
Time interval (△T)measurement accuracy（full bandwidth）	Single: ±(1 sampling interval time +100ppm×reading+0.6ns) >average 16 : ±(1 sampling interval time +100ppm×reading+0.4ns)	

Vertical

Analog digital converter（A/D）	With the resolution of 8 bits, make sampling on both channels synchronously.	
Displacement range	±2 V(5 mV/div ~ 200 mV/div), ±50 V(500 mV/div ~5 V /div)	
Analog bandwidth	HDS1021M-N	20 MHz
	HDS2061M-N	60 MHz
	HDS3101M-N	100 MHz
Single bandwidth	Full bandwidth	
Low frequency response（AC coupling, -3dB）	≥10 Hz（at the BNC ）	
Rise time（typical one at the BNC）	HDS1021M-N	≤17.5 ns
	HDS2061M-N	≤ 5.8 ns
	HDS3101M-N	≤ 3.5 ns
DC gain accuracy	±3%	
DC measurement accuracy（average value sampling mode）	The voltage difference (△V) between any two points on the waveform after averaging the captured waveforms more than 16: ±(5% reading + 0.05 divisions).	

Trigger

Triggering level range	±6 divisions from the screen center
Triggering level accuracy (typical) which is applicable to the signal with rise and fall time equal to or longer than 20ns	±0.3 divisions
Trigger displacement	655 divisions for pre-triggering and 4 divisions for post-triggering.

Trigger Holdoff range	100 ns – 10 s
Make a 50% level setting (Typical).	Operation with the input signal frequency equal to or larger than 50Hz.
Signal system and line/field frequency (Video triggering mode)	Support the NTSC, PAL and SECAM broadcasting systems of any field or line frequency.
Cymometer	
Readout resolution	6 digits
Frequency range	AC coupling, 2 Hz to full bandwidth
Single source	● when the triggering mode is edge triggering, it is a one channel Cymometer. ● When the triggering mode is video triggering，the cymometer will not work..

Measurement

Cursor measurement	Voltage difference (△V) and time difference (△T) between cursors
Auto measurement	Peak-to-peak value, average value, root mean square value, frequency , period， Vmax, Vmin， Vtop, Vbase, Vamp, Overshoot, Preshoot, Rise Time, Fall Time, +Width, -Width, +Duty, -Duty.

Probe

	1X position	10X position
Bandwidth	Up to 6 MHz (DC)	Up to full bandwidth (DC)
Attenuation rate	1: 1	10: 1
Compensation range	15 pf – 35 pf	
Input resistance	1 MΩ ± 2％	10 MΩ ± 2％
Input Capacitance	85 pf – 115 pf	14.5 pf - 17.5 pf
Input voltage	＜200 V DC + Peak AC	＜600 V DC + Peak AC

10.1.2 Meter

Voltage (VDC)

Input Impedance: 10 MΩ.

Max. Input Voltage: 1000 V (DC or AC peak value)

Range	Accuracy	Resolution
400.0 mv	±1%±2 digits	100 uV
4.000 V		1 mV
40.00 V		10 mV
400.0 V		100 mV
1000 V		1 V

Voltage (VAC)

Input Impedance: 10 MΩ

Max Input Voltage: 750 V (AC, RMS value)

Frequency range: from 40 Hz to 400 Hz

Display: RMS value of the sine wave

Range	**Accuracy**	**Resolution**
4.000 V	±1%±3 digits	1 mV
40.00 V		10 mV
400.0 V		100 mV
750 V	±1.5%±3 digits	1 V

Direct Current (DC)

Range	Accuracy	Resolution
40.00 mA	±1.5%±1 digit	10 uA
400.0 mA	±1.5%±1 digit	100 uA
10 A	±3%±3 digits	10 mA

Alternating Current (AC)

Range	Accuracy	Resolution
40.00 mA	±1.5%±3 digits	10 uA
400.0 mA	±2%±3 digits	100 uA
10 A	±5%±3digits	10 mA

Resistance

Range	Accuracy	Resolution
400.0 Ω	±1%±3 digits	0.1 Ω
4.000 kΩ		1 Ω
40.00 kΩ		10 Ω
400.0 kΩ		100 Ω
4.000 MΩ		1 kΩ
40.00 MΩ	±1.5%±3 digits	10 kΩ

Capacitance

Range	Accuracy	Resolution
51.20 nF	±3%±3 digits	10 pF
512.0 nF		100 pF
5.120 uF		1 nF
51.20 uF		10 nF
100 uF		100 nF

Diode: Voltage reading: 0 V - 1 V.

On-off Test: There is a beep sound when the on-resistance is less than 50 Ω.

10.1.3 General Specifications

Basic parameter

Mechanical dimension	18 cm×11.5 cm×4 cm	
Weight	645 g	
Power consumption	HDS1021M-N HDS2061M-N	＜ 6 W
	HDS3101M-N	＜ 7 W
Display type	3.7" color liquid crystal display	
Display resolution	640 (horizontal) ×480 (vertical) pixels	
Display color	65536 colors	

Power Adapter

Power supply	100 - 240 V AC 50/60Hz
Voltage output	8.5 VDC
Current output	1500 mA

Battery type: 7.4V built-in Li-ion battery.

Working environment

Temperature

Operation	Used battery	0 to 50 °C (32 to 122 °F)
	Power adapter	0 to 40 °C (32 to 104 °F)
Storage	-20 to 60 °C (-4 to 140 °F)	

Humidity

Operation	0 to 10 °C (32 to 50 °F)	no condensation
	10 to 30 °C (50 to 86 °F)	95 %
	30 to 40 °C (86 to 104 °F)	75 %
	40 to 50 °C (104 to 122 °F)	45 %
Storage	-20 to 60 °C (-4 to 140 °F)	no condensation

10.2 Appendix B: Maintenance and Cleaning

10.2.1 Maintenance

Do not store or place the instrument in locations where the liquid crystal display (LCD) may be directly exposed to the sunshine for a long time.

Be careful: Do not spray liquid into the instrument.

Cleaning

Inspect the instrument and the probe frequently in accordance with operating conditions. Clean the outer surface of the instrument according to the following steps:

1. Wipe off the floating dust outside of the instrument and the probe by using soft cloth. When cleaning the LCD, do not scuff the transparent LCD protective screen.
2. Wipe the instrument in power off status by soft cloth that is moist but not dripping. It is allowed to be cleaned by soft detergent or fresh water. Do not use any abrasive chemical detergent to avoid the instrument or the probe being damaged.

Warning: Before running, please confirm that the instrument has been dried out so as to avoid electrical short circuit and personal injury caused by moisture.

10.2.2 Storage of Oscilloscope

If the test tool is to be stored for a long time, it is required to charge the lithium battery before storage.

Charging the oscilloscope

The lithium battery is possibly not charged when delivery. To make the battery with enough electric quantity, it must be charged for 4 hours (the test tool must be turned off during charging). The battery can supply power for 4 hours after being charged completely.

When supplying power by using the battery, a battery indicator is displayed on the top of the screen to show the consumption condition of electric quantity. shows that the battery can only be used for about 5 minutes. To charge the battery and power the instrument, connect the oscilloscope using a power adapter according to Figure 1 to charge the battery. The charging speed can be increased by turning off the test tool.

Notice

To avoid superheat of battery during charging, the environment temperature is not allowed to exceed the permissible value given in technical specification.

Note:

No hazard will occur even connecting the charger for a long time, e.g. during a whole weekend. The instrument can automatically switch to slowly charging status.

10.2.3 Replacing the Lithium Battery Unit

It is usually not required to replace the battery unit. But when it is required to replace it, only qualified personnel can carry out this operation, and only use the same specification lithium battery.